july
1957

MACHINE AND TOOL

blue book

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a hitchcock publication

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Only on a MARVEL No. 8 does the blade remain at a right angle throughout its full 18" feed traverse. Work always remains stationary.

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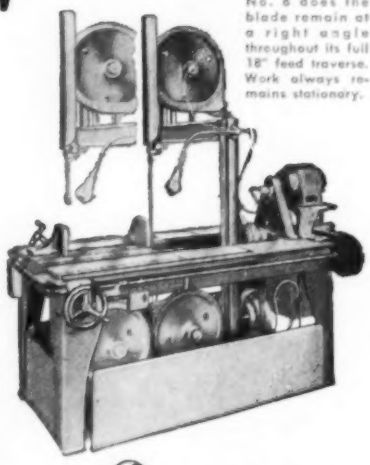

Only a No. 8 MARVEL can do all of these things: Snip-off a ⅛" rod or cut-off an 18" x 18" cross section.

Rough to Size and Shape

Miter

Index

cut off and shape Structural Beams

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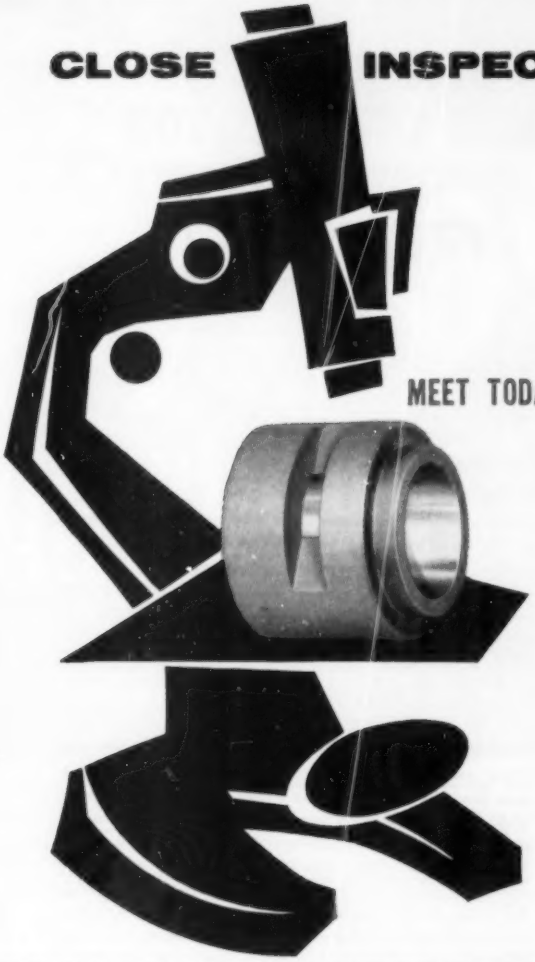

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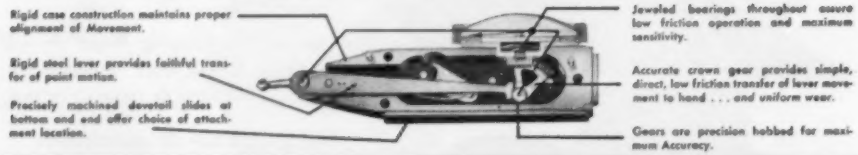
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New

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(opposite Hand TL)
Holds Triangular 6-edge, Armide and other carbide "throw-away" inserts.

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(opposite Hand SL)
Holds square, 8-edge, Armide and other carbide "throw-away" inserts.

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Reader's Guide

MACHINE AND TOOL blue book

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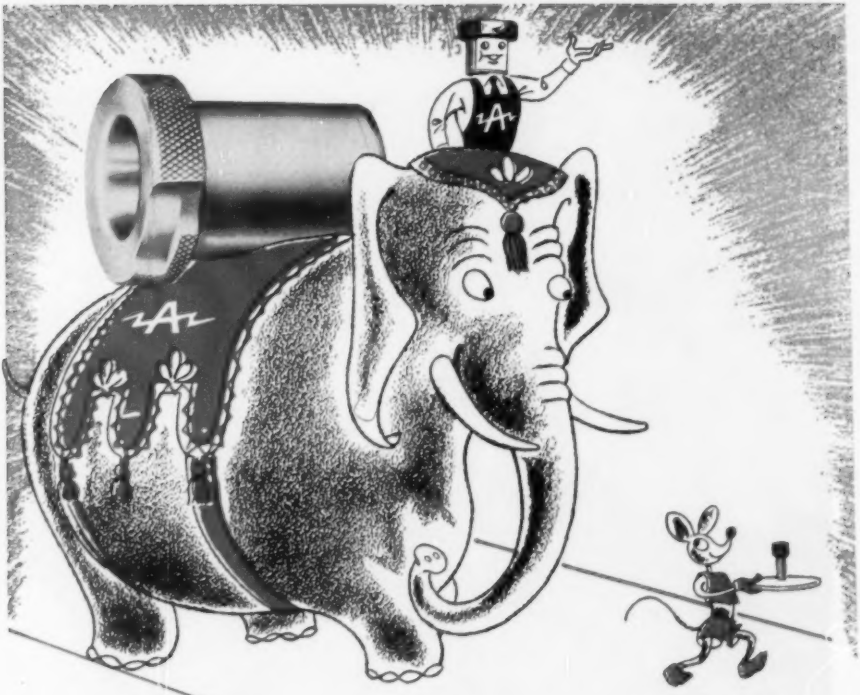

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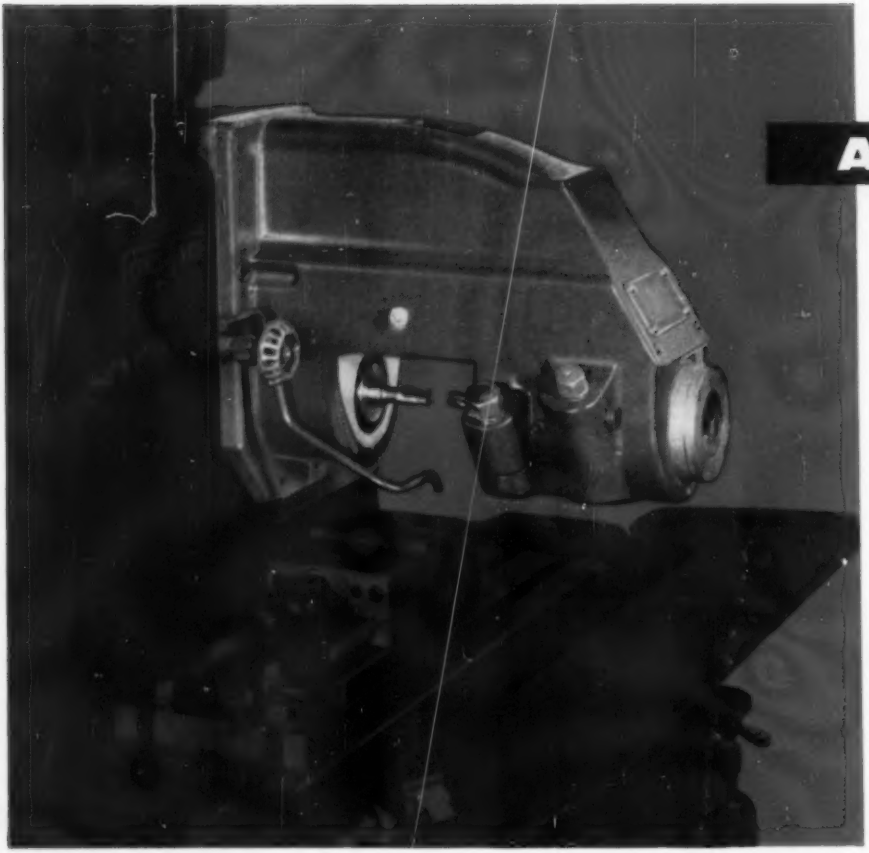
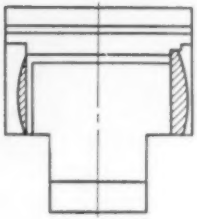


CINCINNATI No. 0-8 Plain Rise and Fall Milling Machine equipped with duplex head.

Drawing of part
(shaded areas indicate milled surfaces)



Part name ..... rear sight base
Material ..... steel forging
Operation ..... mill two sides
Production ..... 223 per hour

CINCINNATI

Head For

Low-Cost Production

Duplex Head on Cincinnati 0-8 Plain Rise and Fall Mills an Extra Surface

This machine has a head for business. It's a CINCINNATI® No. 0-8 Plain Rise and Fall Milling Machine, equipped with a duplex head to mill **both sides** of small parts in **one cycle**, and **one handling** of the work.

Production averages 223 parts per hour, about double what it would be without the Duplex Head. The drawing on the opposite page indicates surfaces milled.

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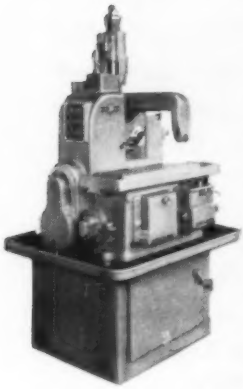

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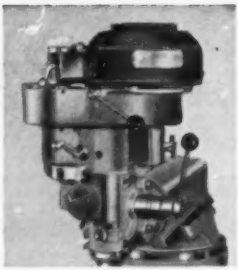

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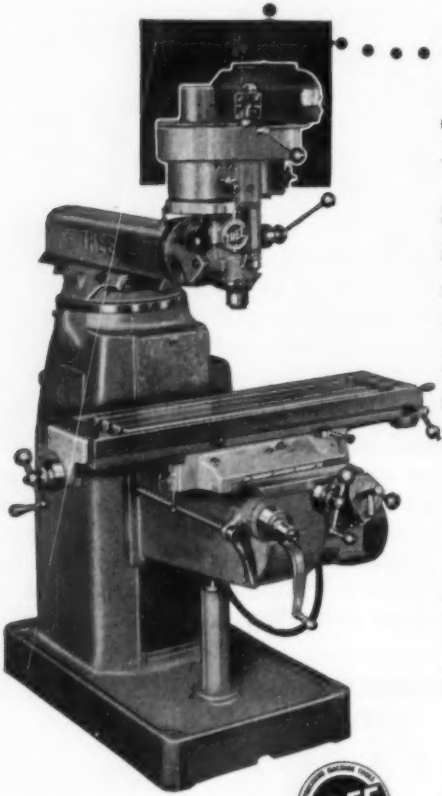

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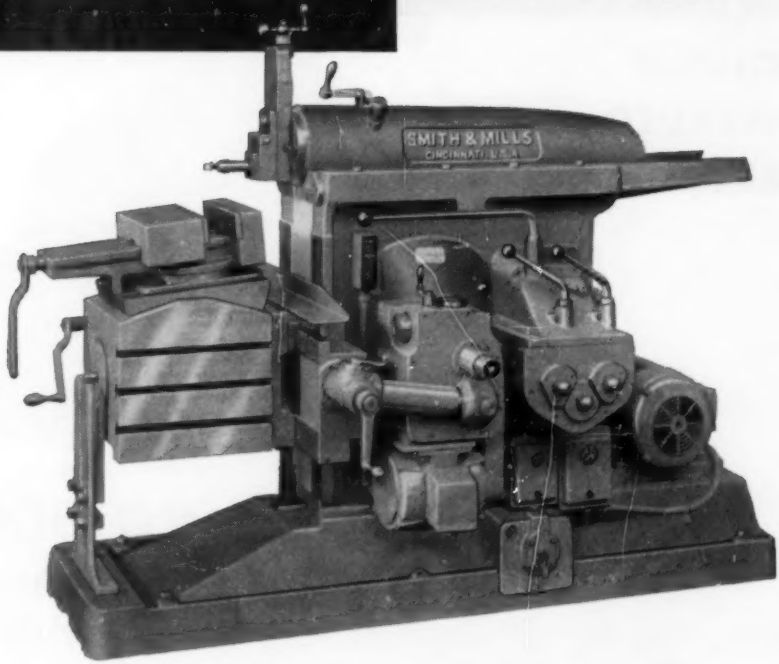

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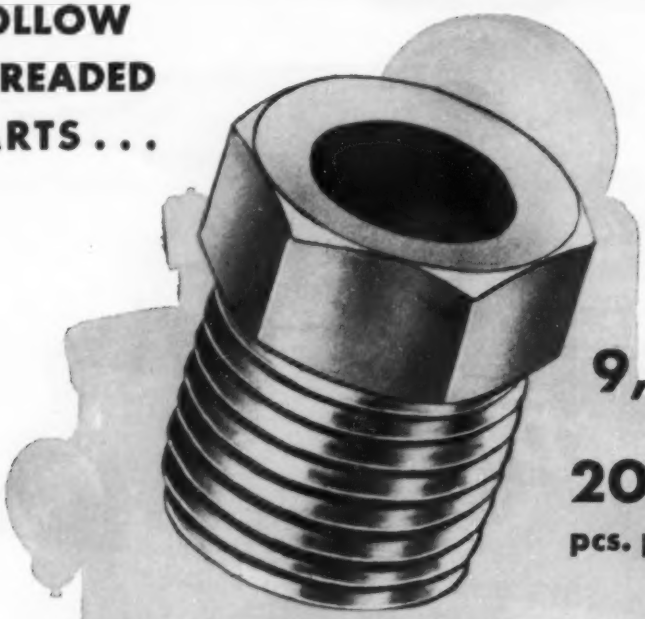

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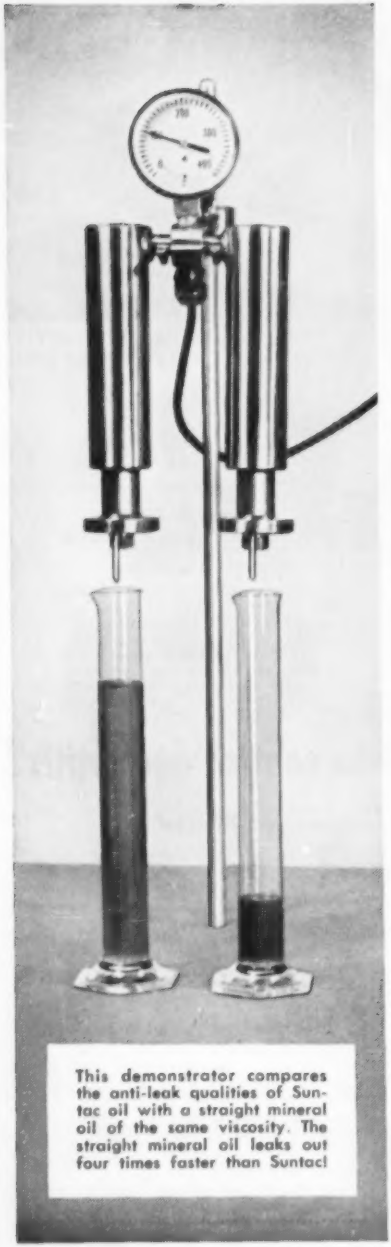

This demonstrator compares the anti-leak qualities of Suntac oil with a straight mineral oil of the same viscosity. The straight mineral oil leaks out four times faster than Suntac!

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For fast, economical cutting of flat metal shapes there are

7 MODELS OF Campbell Nibbling Machines

...with cutting capacities ranging from 3/32" mild steel for **MODEL 0** machine to 1/2" mild steel for **MODEL 530**, in sheet sizes from 16" or less, to 72".

CAMPBELL NIBBLERS are making tremendous savings in time and money for hundreds of users in aircraft and other metal-working plants.

...in fast cutting of ferrous and non-ferrous sheet metals or composition sheets.

...for moderate production runs or experimental development work.

Economical "throw-away" punch and die

• CAMPBELL NIBBLERS cut from 40 to 60 times faster than drilling or filing. A fast-moving punch (350 to 900 strokes per minute) operating over a die, nibbles out the design, taking a small "bite" with each stroke of the punch.

...for any and all kinds of shapes

...for either inside or outside cuts

...with no distortion of material—no internal strains —no invisible fractures—no burr

...with a "nibbled" edge that is sufficiently smooth to require very little finishing and sometimes none

CAMPBELL standard punches are made double end to double work life and halve the cost. Prices are so low (starting at 40c each, or 20c per working end) that new punches cost less than regrinding dull ones.

Here is a quick picture of CAMPBELL NIBBLING MACHINE Capacities

Campbell Nibbler Model #	Sheet Width	WORKING CAPACITY Sheet Thickness Mild Steel	Alloy Steel	Strokes per Minute
0	16"	3/32"	1/16"	900
1A	20"	3/16"	1/8"	375-650
430	60"	3/8"	1/4"	350-525
436	72"	3/8"	1/4"	350-525
530	60"	1/2"	5/16"	350-525
2524	48"	1/4"	3/16"	375-650
2536	72"	1/4"	3/16"	375-650

Send for this catalog for complete information on this versatile production and experimental tool

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ACCO

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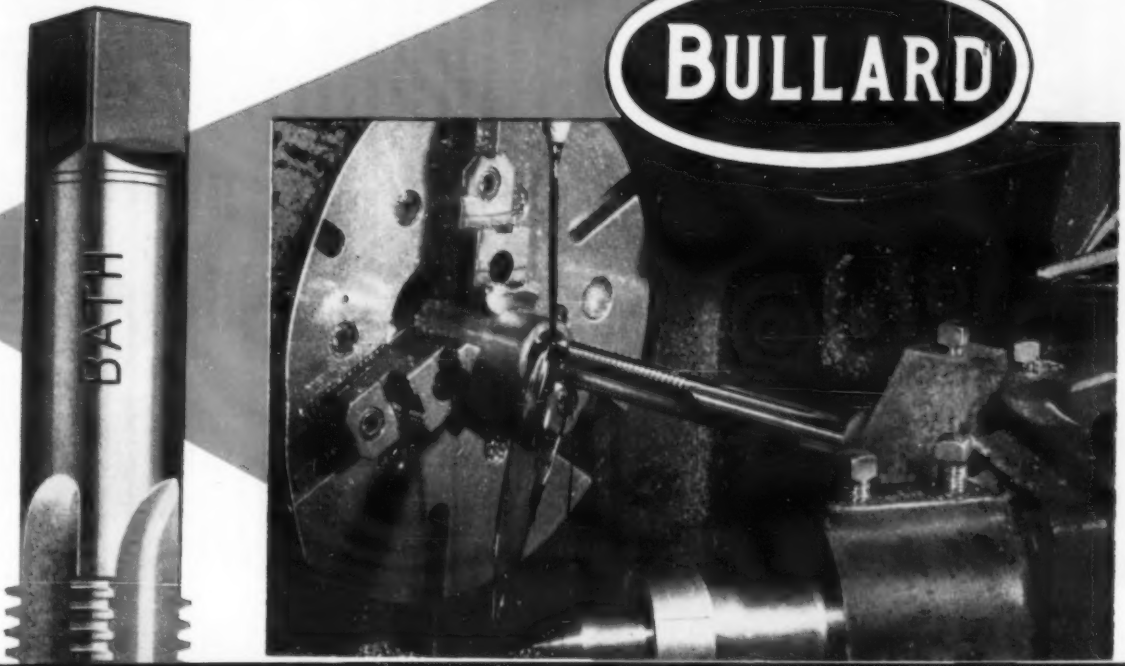
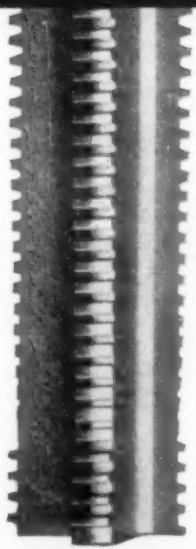
another Bath Tap job well done . . for





Bath Acme Tap being used to tap cross rail cross feed nut for Bullard Cut Master Vertical Lathe. Thread: 1⅝"-4 double ¼ pitch, ½" lead Acme thread. Material: SAE #65 bronze.

As a user of Bath Acme taps for about 30 years, The Bullard Company of Bridgeport, Conn., well-known manufacturers of the Cut Master and Man-Au-Trol Vertical Turret Lathes and other modern machine tools states:

"We have had ample proof of the cooperation of the Bath organization in solving tapping problems, particularly those involving difficult Acme threads. On many jobs, we have been able to produce more efficiently and to improve the quality of Bullard machine parts as a result of special study in tap design by Bath engineers and skilled craftsmanship in tap manufacture."

If you are experiencing difficulty with any of your tapping or gaging, let Bath engineers work with you — as they did with The Bullard Company.

JOHN BATH & CO., Inc.

14 Grafton St., Worcester, Mass.

CYLINDRICAL AND THREAD GAGES · GROUND THREAD TAPS · INTERNAL MICROMETERS

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the technical know-how to "*engineer*" more speed and profit into your assembling operations.

● The signal success of DPS trained engineers in adapting power equipment to the individual feeding and assembling needs of industrial plants everywhere is assurance that they can likewise solve your special problems. In our broad line of

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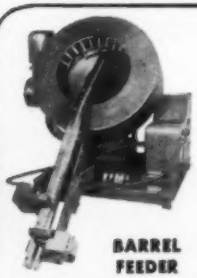
POWER SCREWDRIVERS
SPECIAL ASSEMBLING MACHINES

equipment can be selected, and custom features incorporated, to fit your requirements. Plan now to use DPS modern assembling methods. Tell us your set-up. Write for catalog and further details.

BOWL FEEDER
Electrical vibratory type to feed parts that cannot be tumbled.

POWER SCREWDRIVERS
An extensive, versatile line in both bench and pedestal types.



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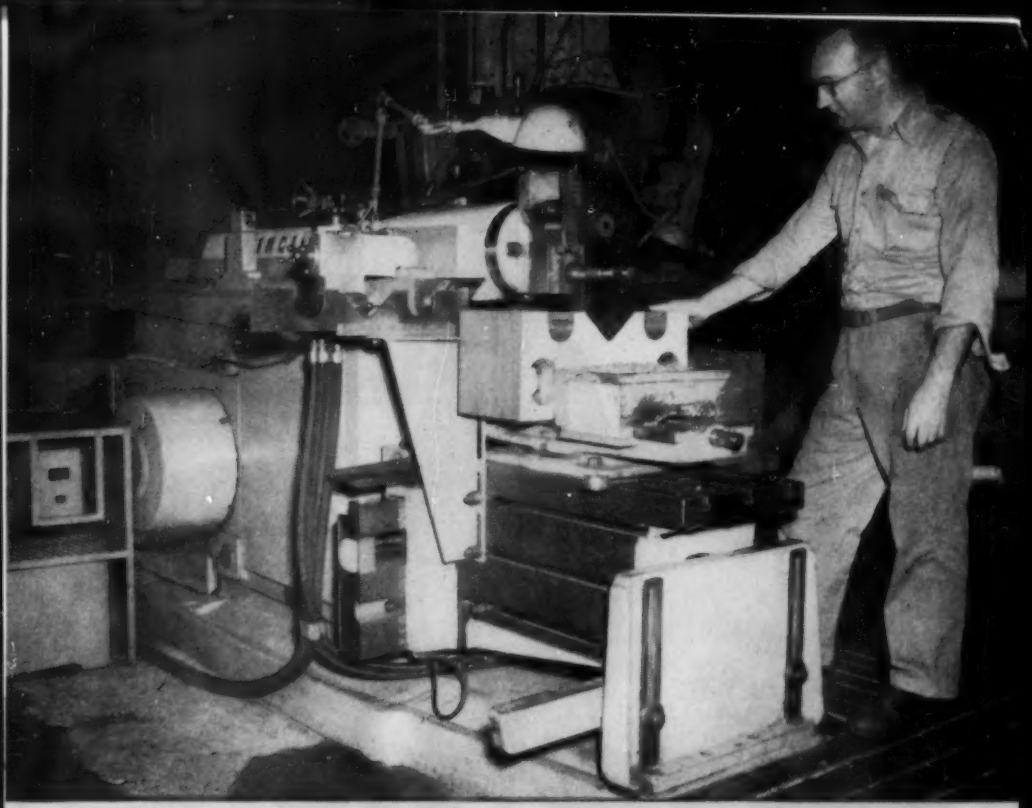


Photograph courtesy of Heppenstall Company, Pittsburgh 1, Pa.

High-alloy shear knives machined on accurate Cincinnati Rigid Shaper...

at HEPPENSTALL COMPANY, Pittsburgh 1, Pa.

This Cincinnati 36" Rigid Shaper, equipped with an automatic contouring unit, is machining high-alloy steel shear knives. These knives will be used to cut 3" round-cornered squared billets and 2½" rounds, by a leading Midwestern drop-forge company.

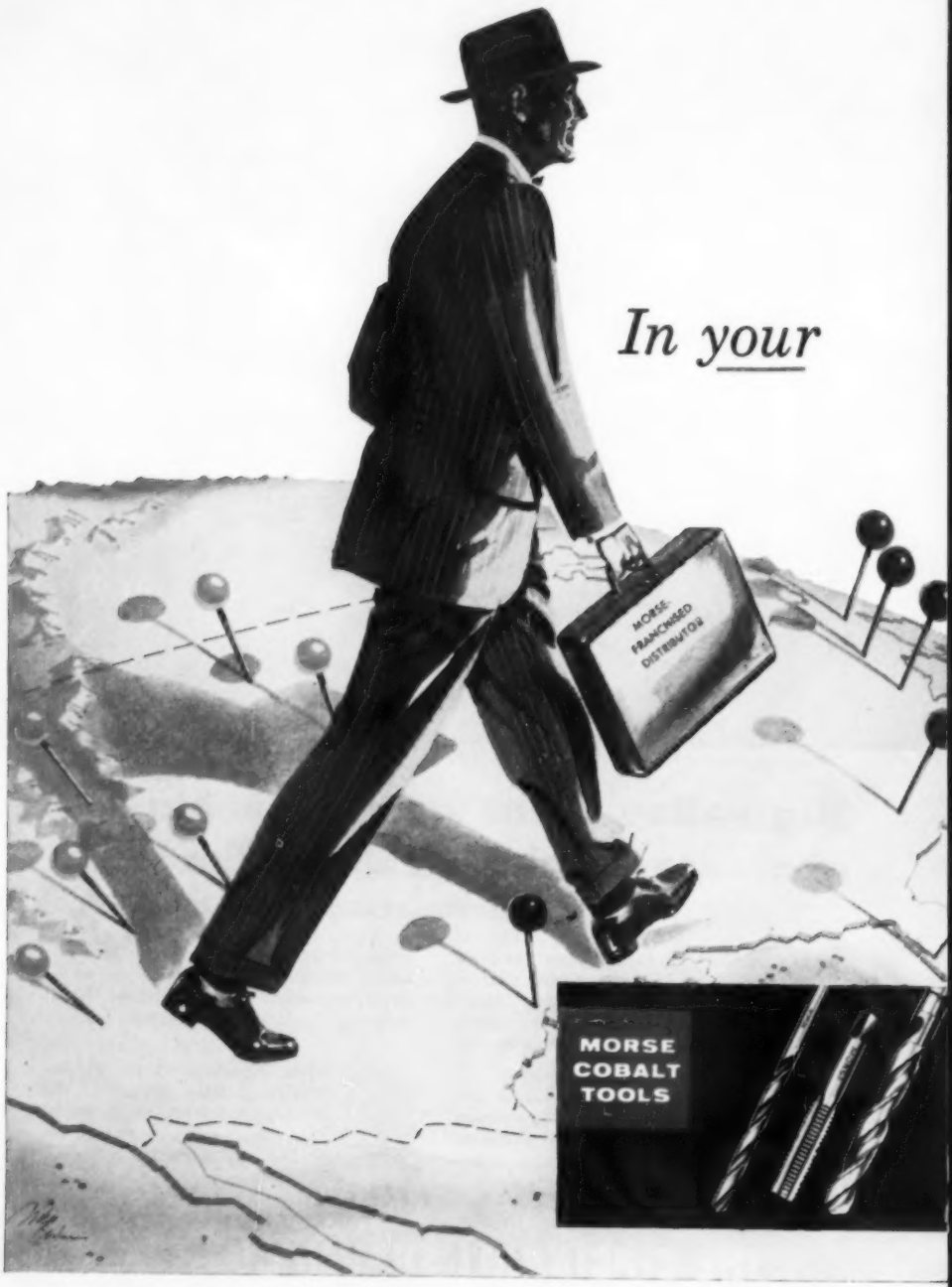
The heavily ribbed column, extended ram bearing and slot-free ram insure minimum deflection and maximum accuracy. Exclusive Cincinnati 50 psi pressure lubrication is real insurance against wear. The Cincinnati electro-magnetic brake and clutch with finger tip control is positive and trouble free. Faster on the job . . . Easier on the operator

Write Department H for Bulletin "Cincinnati Rigid Shapers". We also suggest you consult our Application Engineering Department regarding your machining problems.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS - SHEARS - PRESS BRAKES

CINCINNATI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territory and any territory...

the top **ISD**
(the man we deal with exclusively)

is the **MFD**
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Here's why **MORSE**
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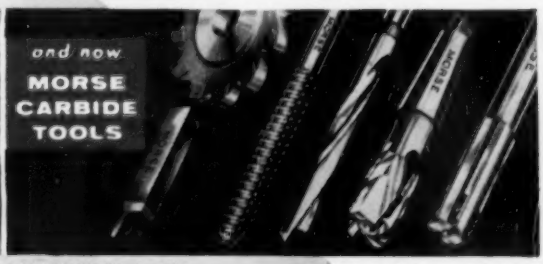
(World's Most Complete Line of Finest Quality Tests)



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(Subsidiary of VAN NORMAN INDUSTRIES, INC.)

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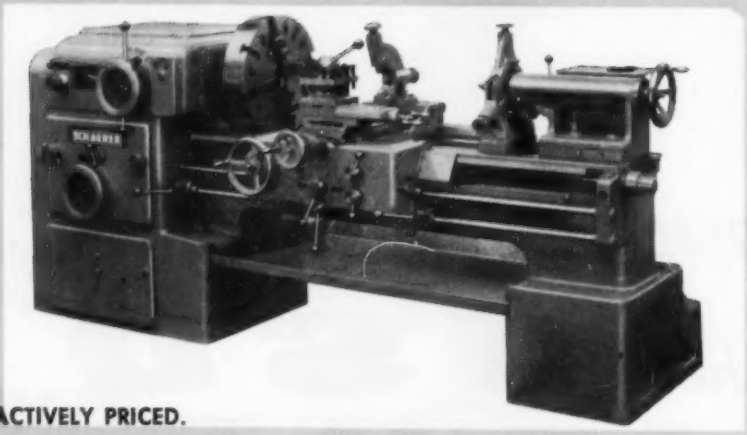

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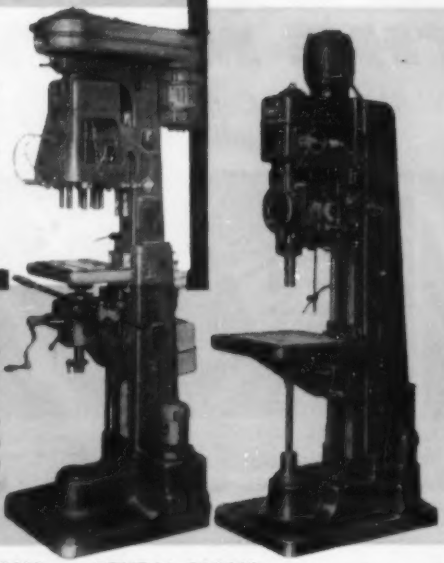
SCHAERER LATHES

Featuring:

- **SADDLE AND APRON ARE CAST IN ONE PIECE AND RIDE IN UNDERSLUNG DOUBLE VEE WAYS.**
- Centralized lubrication.
- Underslung double V-guide bed, fully protected against damage, for long life.
- Automatic lubrication, easy maintenance, easy cleaning.
- Swing from 20" to 44"
  Bed lengths to 35'

STARRETT *DRILLING MACHINES*



Spindles can be fixed in any position, circles, straight lines or irregularly. Spindles rotate at different speed ranges.

Featuring:

- All-gear transmission from shaft to spindle.
- Case-hardened, tempered ground gears.
- Automatic feed, with 4 normal, 4 rapid speeds.
- Instant-fixing, predetermined depth control.
- Ball and roller bearings throughout.

LIBERAL TERMS — RENTAL PLANS

See Page 51

AARON
MACHINERY CO., INC.

DEP'T "B"
45 CROSBY STREET
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no one has ever paid for service

There's never been a charge . . . never . . . for factory service on a Fulmer Honing Machine! And Fulmer Service is far more than an empty phrase. A company airplane is maintained to deliver service personnel and replacement parts, often in a matter of hours to meet an emergency. Fulmer machines offer the following added advantages:

FASTER . . . EASIER . . . MORE ECONOMICAL PRECISION-HONING OF INTERNAL BORES

. . . for FULMER HONING MACHINES

Amazingly fast . . . stock removals up to 1½ cu. in. per minute; geometrically accurate . . . surface finishes down to one micro inch, rms . . . identical finish from hole to hole . . . generous overload capacity, etc.

Fulmer precision honing machines can do for you what they are doing all over the world — save time and money! Write for Bulletin on Honing to: C. Allen Fulmer Co., Dept. B, 107 E. 4th St., Cincinnati 2, O.

FULMER honing equipment

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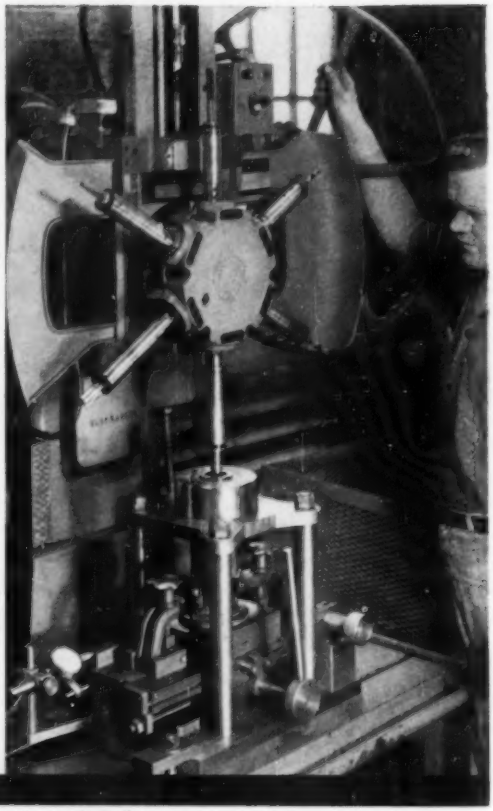
"Our BURGMASTER® turret drill saves 43% running time over turret lathe"

Graymills Corporation, Chicago

states "two things make operations on the gear pump body casting somewhat unusual. (1) gear pockets are *bored* to close tolerances; (2) *both* pocket and shaft holes are machined on different centers by shifting the casting approximately ¾" in the fixture.

The setup, as worked out on our Burgmaster equipped with Power Feed, (see illustration) is producing much more accurate pieces with fewer rejects. Our running time is 57% of that on the turret lathe and we have been able to release the much more expensive lathe for other work. In addition, the Burgmaster is much easier to operate."



Sequence of operations on 6-spindle Burgmaster turret drill is as follows:

1	Load	9	Counter bore—rough 2nd gear pocket
2	Counter bore—rough 1st gear pocket	10	Bore—finish 2nd gear pocket
3	Bore—finish 1st gear pocket	11	Skip
4	Drill—rough ½" shaft hole	12	Drill—rough ⅜" shaft hole
5	Skip	13	Skip
6	Ream—finish ½" shaft hole	14	Ream—finish ⅜" shaft hole
7	Skip	15	Unload
8	Shift fixture—hold tolerances by using dial indicator		

Note arrangement of tooling sequence. By skipping stations, machining of the entire piece and shaft holes of two different sizes is possible. Depth is controlled by the standard Burgmaster micro-stops. All dimensions are ±.0005".

For complete information, write Dept. MT-7

BURG TOOL
Manufacturing Company, Inc.
15001 South Figueroa Street, Gardena, California

RIDGEWOOD, N. J. • CHICAGO • CLEVELAND • DETROIT • SAN LEANDRO, CALIF.

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10% faster welding results from using Jetweld LH-70 for welding nickel-chrome-moly blocks and hangers to forging in fabrication of forks and lift trucks. Courtesy Joseph Dyson & Sons, Inc. Cleveland, Ohio.

TRY THIS ON HARD-TO-WELD STEELS

LINCOLN'S JETWELD LH-70 LOW-HYDROGEN IRON-POWDER ELECTRODE

Write for Bulletin SB-1351 for specifications

- ***DEPENDABLE*** welding of crack-sensitive steel, alloy steels without preheating, medium to high carbon steels, free machining steels.
- ***FAST,*** has higher deposition rate than conventional low-hydrogen electrodes.
- ***EASY*** operation in all positions.
- ***E-6016*** also conforms to class requirements of E-6015, E-7015 and E-7016.
- ***OPERATES*** on AC or DC.

THE LINCOLN ELECTRIC COMPANY

Dept. 3615 Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

When Jetweld LH-70 **Has** a faster deposition rate **Yet** welds hard-to-weld steels

WHY use anything but Jetweld LH-70 on crack-sensitive steel?

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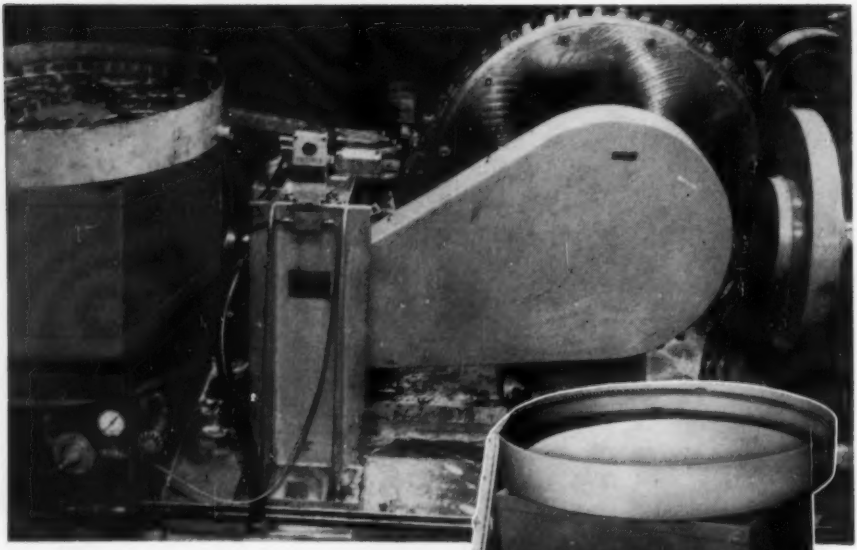

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Vertical Vibratory —PARTS FEEDERS

—meet all the requirements for completely automatic production —continuous feeding—proper positioning and timing of parts to processing or assembly machines.

SYNTRON Parts Feeders with their gentle vibrating action and rheostat controlled rate of feed have successfully handled parts of every size, shape and material. They are adaptable to deburring, marking, indexing, assembly and other automatic machinery by means of gravity feed tracks with controlled escapements. Each Parts Feeder is custom designed for parts to be handled.

Syntron's years of experience are available to you—Send parts samples to our application engineers for recommendations.

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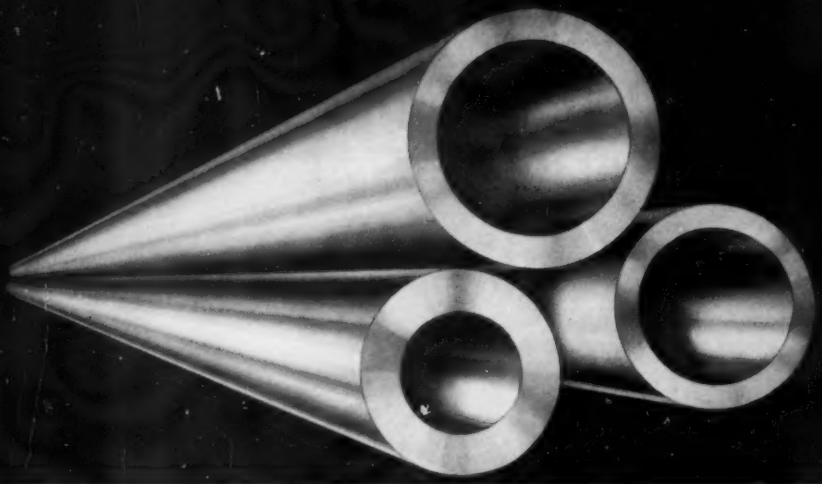
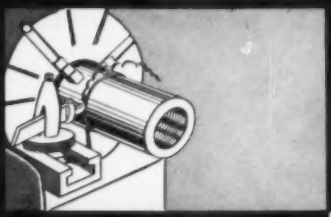
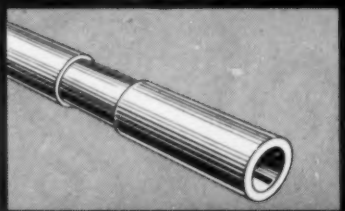
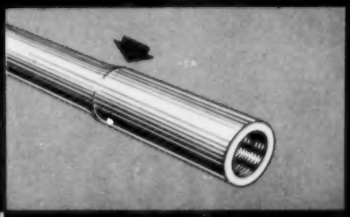




Worn drill collars are "peeled down" for perfect roundness, eliminating surface scars and imperfections.



Tubing sleeve is shrunk into perfect position.



Sleeves are securely welded. Thus drill collars go back into service actually as good as new.

MATCHING TUBES TO JOBS

Drill collars and tool joints can't last forever in oil well equipment service. Abrasive wear reduces the strength and the safe minimum O.D., and makes the bearing faces eccentric. When so worn, they are repaired by using sleeves — as shown above. One producer of such equipment brought a problem to B&W—"How could this 'sleeve' job be done with a minimum cost in equipment, operations, material and time?"

Because of the diversity of its types of tubular products and experience in matching tubes to jobs B&W was able to supply tubing in the proper type, size and grade and with appropriate tolerances and physical properties. This, in turn, reduced the number of fabricating operations and eliminated excessive machining and the need of some fabricating equipment. This manufacturer was able to "repair and place in as good as new condition" these rather expensive products—and at a substantial reduction in cost.

Friendly Mr. Tubes — your link to B&W—is the man to call when tubing can save the day in your own operation. His business is matching tubes to jobs — jobs like yours. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA-6106-M6

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels.

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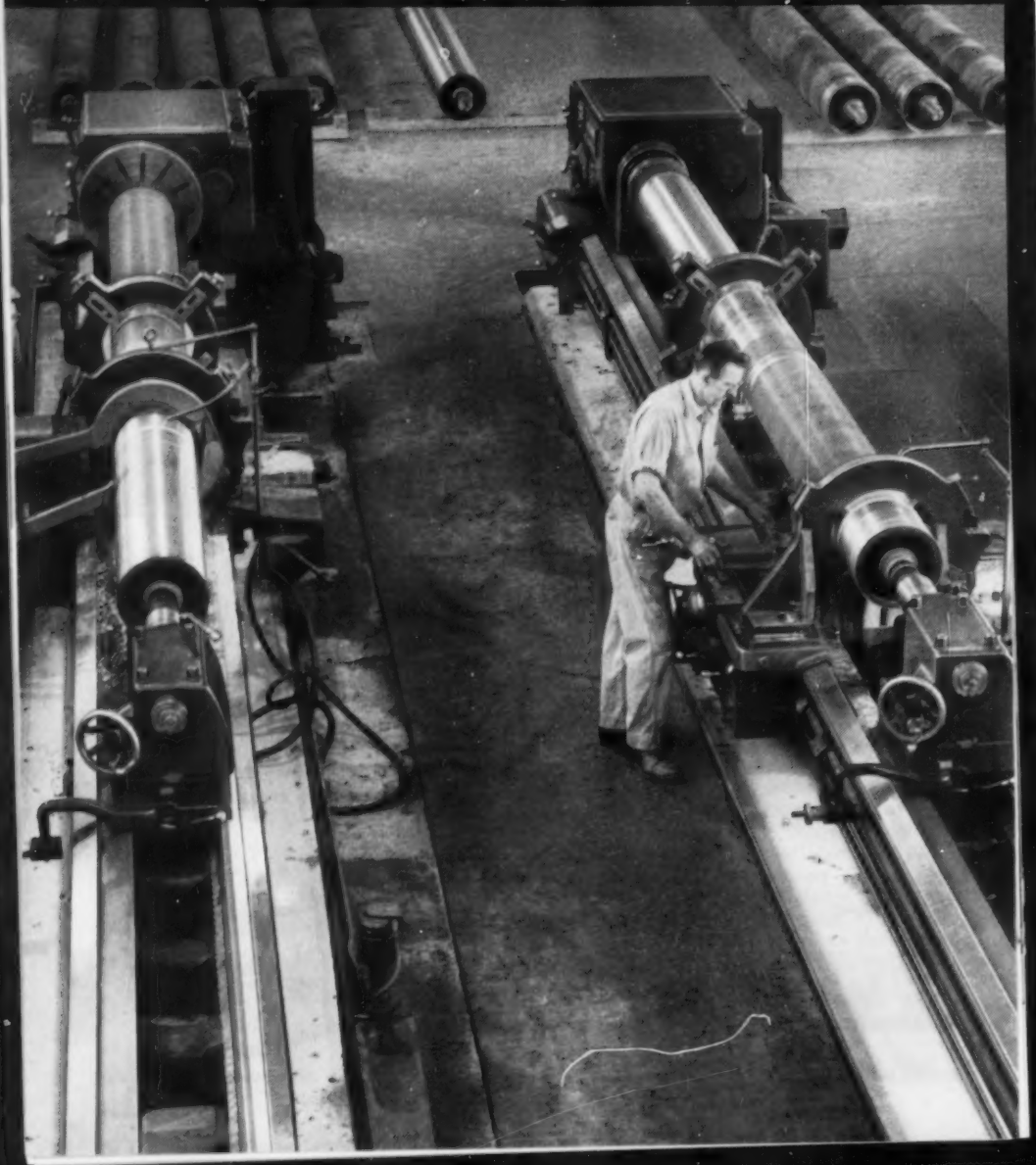
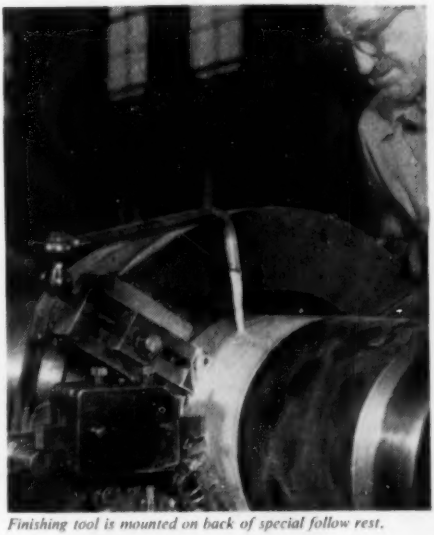
Beloit Eastern needed LeBlond

Two of the eight LeBlond 25" and 32" Heavy Duty Engine Lathes in Beloit Eastern's new pipe roll shop.



rigidity for this 3 in 1 turning idea



Finishing tool is mounted on back of special follow rest.

LeBlond lathe owners often tell us about unusual ways they are able to use our machines. There's a reason. The rigidity, accuracy, weight—the unique features of LeBlond lathes encourage owners to expect a little more of them. With LeBlonds they confidently develop turning techniques that they just couldn't expect an ordinary lathe to handle.

Take this pipe roll "skinning" job at Beloit Eastern Corporation, Downingtown, Pa. These 23′ extruded wrought steel pipe rolls must mate perfectly in high-speed paper making machinery. This calls for straight and true machining accurate to .002 end to end—in itself, a stringent test of lathe rigidity.

But Beloit Eastern had to "skin" costs, too. So they took advantage of LeBlond's unique tailstock design with their unusual 3 in 1 turning idea. Now rolls are roughed, finished and polished all in *one* operation:

1. **ROUGHING**—Carbide tool is mounted on the compound.
2. **FINISHING**—A special solid ring-type follow rest (bolted to the carriage wings) carries a tool block and high-speed finishing tool.
3. **POLISHING**—A wooden emery paper holder made like a clamp is tied together against the turning pressure of the roll.

Spindle rigidity of the LeBlond tailstock, when greatly extended, actually makes this cost-saving method possible, since room must be made for follow rest at beginning of cut. The tailstock spindle even when extended, has full-length support thanks to exclusive LeBlond Thrust Lock design.

Ask any LeBlond lathe owner. He'll tell you he likes LeBlonds because he can count on them—for more rigidity, more usable power, more years of dependable, accurate turning. After all, isn't that what *you* want in a lathe? Today, get all the details on the complete LeBlond line of heavy duty turning machines, the most dependable lathes in the world. Call your LeBlond Distributor or write. *Ask for Bulletins HD-156 (25") and HD-165 (32").*

. . . cut with confidence

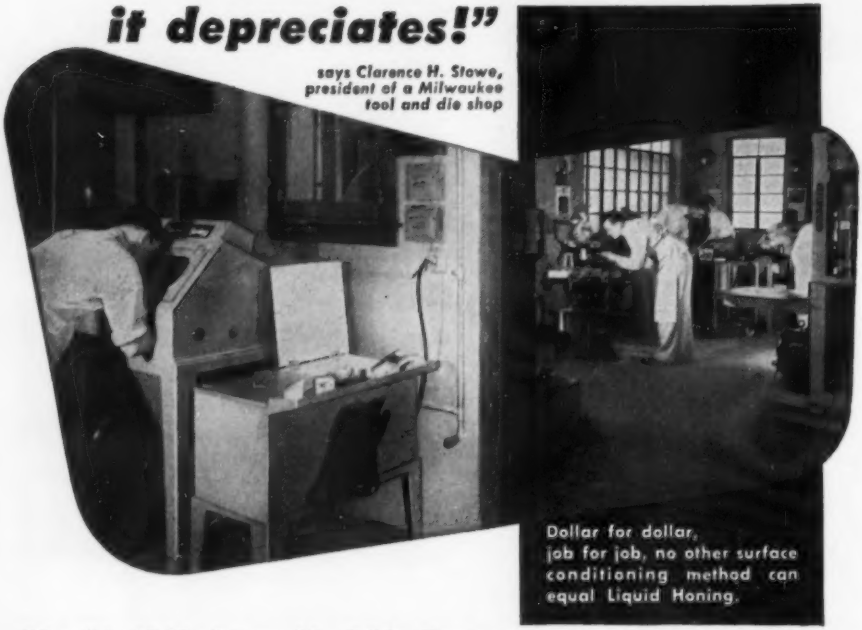
THE R. K. LEBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

LeBLOND of Cincinnati

World's Largest Builders of a Complete Line of Lathes for More Than 70 Years

"Liquid Honing* pays for itself 5 times faster than it depreciates!"

says Clarence H. Stowe, president of a Milwaukee tool and die shop



Dollar for dollar, job for job, no other surface conditioning method can equal Liquid Honing.

"Our Liquid Honing machine," Mr. Stowe continues, "enables us to remove heat-treat scale instead of waiting for the heat treater to do it. Consequently, customers get faster job deliveries.

"In only one-fourth usual time, Liquid Honing cleans molds for repairs or remodeling — and ends what used to be a difficult, tedious hand operation.

"Many die casting and plastic molds now go out with an oil-retaining Liquid Honed satin finish that eliminates hand polishing after final heat treating.

"In addition, we clean hand tools, spare machine parts, cutting tools, electrical contacts — anything small enough to go into our machine. So it's easy to understand why Liquid Honing will pay for itself within a year — *five times faster than it depreciates!*"

That's the Stowe story—a "preview" of a few of many advantages Liquid Honing can bring to your tool room, machine shop or die department. You'll be surprised at the low cost — only $550 to $1500 for a standard machine.

Write for details or send a sample part for free demonstration processing.

*Vapor Blast and Liquid Honing are trademarks.

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Milwaukee 16, Wisconsin

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SAVE up to 60%

on Dies, Templates, Gauges, and Cams with OLIVER DIE MAKING MACHINES

It's a fact! . . . Oliver Die Making Machines have virtually obsoleted the old, time-consuming "drill and chip" method of making dies and similar tools. The Oliver-originated principle of *sawing* out dies has resulted in greater speed, finer accuracy and up to 60% savings in costs. Further, the "Oliver" is so simple to operate that all sawing, filing and lapping can be handled by an ordinary mechanic . . . thus permitting the better utilization of a skilled die maker's more costly time. Ask about Oliver today!

Heavy Duty Model

Available in 5 Low-Cost Models

You'll find, whatever your die making requirements, that Oliver offers the machine you need . . . Bench Types S4 and S1, Pedestal Types SP-2 and SP-1 and the outstanding Heavy Duty Model. Why wait? You'll more than pay for your "Oliver" in die cost savings alone.

Type S-1 Bench Model

SPECIFICATIONS			
	S-4 Bench Model*	S-1 Bench Model*	Heavy Duty Model
Capacity	Saws to center of 17" circle on steel up to 1" thick	Saws to center of 17" circle on steel up to 1" thick	Saws to center of 20" circle on steel up to 3" thick
Table	11¼" diameter	11¼" diameter	18" diameter
Tilt	10° to right, left or front	10° to right, left or front	15° to right, left or front
Strokes per min.	313 & 428	400	100, 125, 175, 215, 250, 300
Length of Stroke	1⅜"	1⅜"	0" to 5"
Drive	V-belt	Direct	V-belt

*Also available in pedestal models.

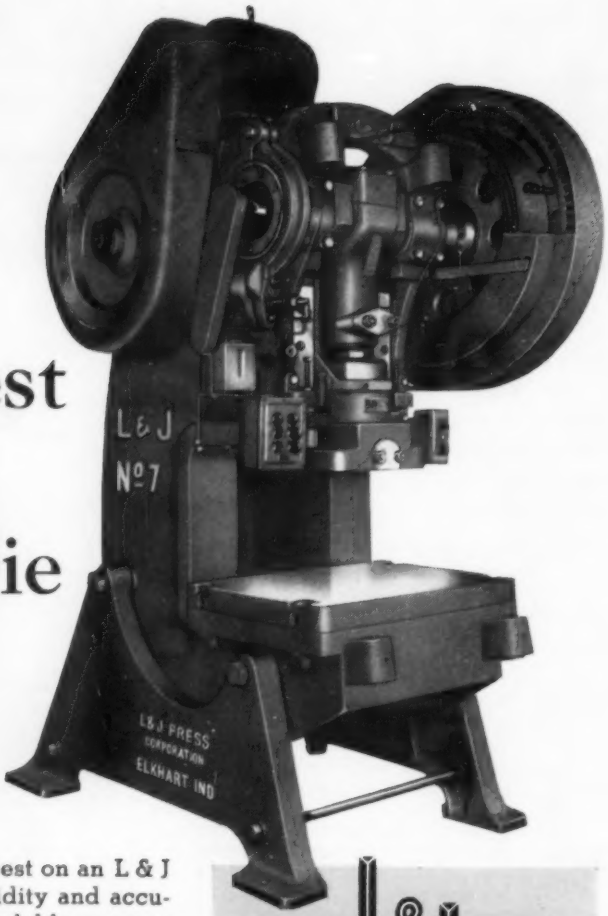
Write today for information

OLIVER of ADRIAN

OLIVER INSTRUMENT COMPANY

1408 E. Maumee St. • Adrian, Michigan

Gets the Best out of Any Die



Any die will do its best on an L & J No. 7 Press. The rigidity and accuracy of these dependable presses provide accurate die alignment that minimizes wear, and insures precision stampings. They also enable dies to produce maximum output for these presses are efficient, versatile and require but minimum maintenance. Write for complete catalog—24 O.B.I. Presses, 14 to 90 tons—20 to 100 ton Straight Side Presses.

NO. 7 L & J PRESS

Capacity—75 tons. **Stroke**—4", special max.—8". **Speed**—42 s.p.m. (85 s.p.m., non-geared). **Throat Depth**—13½". **Die Space**, standard—14", special max.—23". **Bolster Plate**—36" x 26" x 3". Also, non-geared. Air clutch optional.

L & J PRESS CORPORATION 1625 STERLING AVE. ELKHART, INDIANA

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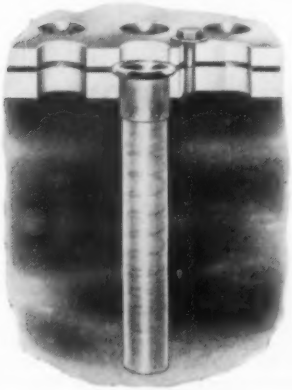
Cost Reducer—

Filter Your Way to Greater Profits with the

Delpark Filter-Matic

TUBULAR SCREEN VACUUM FILTER

Delpark Filter-Matics have widened the spread between cost of manufacture and profit by eliminating certain costs and reducing others.



On grinding operations Delpark Filter-Matics reduce costs these ways:

1. By extended grinding wheel life.
2. By removing contaminants from coolant—extending coolant life.
3. Reduces rejects due to off size by lowering coolant temperature.
4. Reduces rejects due to scratches caused by abrasives carried back to the work in the coolant.
5. Uses permanent filter media.
6. Gives micro-inch finish requirement filtration.

Write today for more complete information on the new Filter-Matic Filter and ways with which it can save you more money.

Delpark

. . . FIRST in Filtration Advancements

INDUSTRIAL FILTRATION COMPANY
22 INDUSTRIAL AVENUE
LEBANON, INDIANA

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REDESIGNED HEADSTOCK is massive, rigid casting, eliminating vibration and assuring maximum accuracy. Electric combination clutch and brake permits fast, smooth starts and stops without overheating. The Gisholt main control (manually or hydraulically operated) and the simple push buttons and feed-stop valves speed changeovers. A wide range of spindle speeds permits peak machining efficiency on all materials.

GISHOLT JETracer (mounted in place of standard front carriage) for either single or multiple pass work. For latter, JETracer will make up to four consecutive, automatic passes from four templates of different lengths and patterns. **Standard rear independent slide** can operate any time within the general machine cycle to complete the part. **Air- or hydraulically-operated tailstock** can be easily mounted, positioned or removed.

High capacity + flexibility = economy

ISN'T THIS WHAT YOU WANT

CONSIDER WHAT YOU CAN DO with this new Gisholt MASTERLINE No. 12 Automatic Production Lathe:

Here is an automatic lathe designed specifically for high production operations—yet this machine is flexible enough to handle a variety of similar parts in small repeat lots.

You can hold work in a chuck or fixture—with a work driver and tailstock—on an arbor or between centers. To start the automatic cycle, your operator simply loads the part, chucks it and raises the Main Control Lever. He is then free to handle additional machines—or to perform other work—until the part is completed.

On the Gisholt No. 12 Automatic, all carriage and slide movements are hydraulically actuated. The front carriage has both longitudinal and transverse motion—or a combination of the two—with quick approach, automatic tool relief and rapid return. You can mount the rear independent slide at any angle to machine bevel gears, drill cones, or handle other parts with angular surfaces.

For special jobs—like machining both ends simultaneously on small motor frames, cylinder sleeves,

MASTERLINE GISHOLT SINCE 1887 GISHOLT

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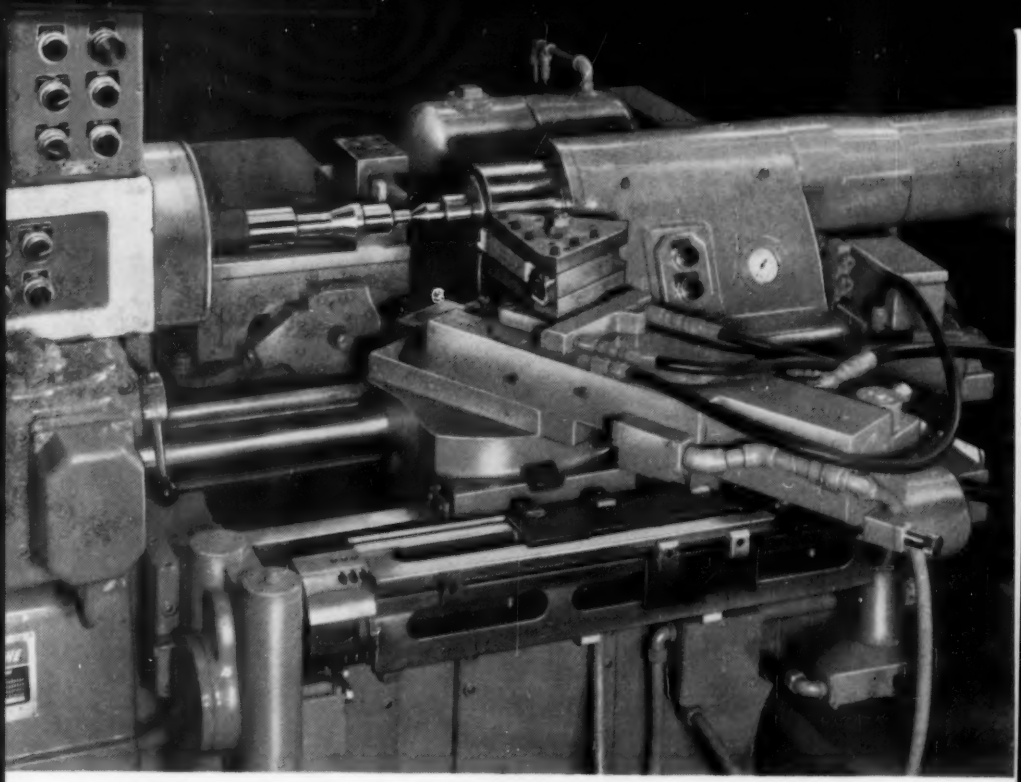

IN AN AUTOMATIC LATHE?

r similar parts— you get even greater flexibility from he No. 12 through auxiliary slides, operated by ovement of the standard slides. Or you can mount back facing attachment within the spindle—for till another way to machine a maximum number of urfaces in one chucking. And for outstanding ver- atility with great savings in tool and setup costs, he front carriage on the No. 12 may be replaced by single- or four-pass JETracer slide.

For complete details of the new features on the Gisholt MASTERLINE No. 12 Automatic Produc- on Lathe, call your Gisholt Representative.

WRITE GISHOLT TODAY for advance data on the new Gisholt MASTER-LINE No. 12 Automatic Production Lathe. Ask for Form 1178.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

URRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

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LOWERS COSTS...

PAYS FOR ITSELF QUICKLY...

The ROUSE HAND MILLER is a widely used, inexpensive, high speed, ball bearing, motor driven machine for handling light cuts in brass, aluminum, steel, plastics, and other materials—fast, accurately, and at very low cost. Only $110.00 Fixtures (illustrated) extra.*

*Motor equipment:—1/4 H.P. 110 Volt AC 60 cycle, single phase, swivel motor mount and light—$36.00**

**All prices FOB Chicago.*

★ **MILLS SMALL PARTS MUCH FASTER.**

★ **DRASTICALLY CUTS YOUR INVESTMENT IN EQUIPMENT.** Replaces expensive production machinery—or releases it for other jobs.

★ **INEXPERIENCED HELP CAN OPERATE IT.** Safe, simple, fool-proof operation.

★ **NO MORE COSTLY SET-UP TIME. $110.00*** price so low that it pays to keep one or more Hand Millers always set-up for special operations.

★ **YOU GET A BETTER PRODUCT**—the result of ABSOLUTE ACCURACY.

★ **A LOSS BECOMES A PROFIT** when marginal pieces are finished on the Hand Miller instead of on high cost equipment.

★ **VERY LOW MAINTENANCE.**

★ **USED REGULARLY IN 1163 MANUFACTURING PLANTS** (some of which use as many as 30 machines)—yet on the market a scant few years.

★ **UNIQUE—VERSATILE.** Nothing else like it. One or several machines can be the answer to some of *your* production problems.

Write today for further information.

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2214 N. WAYNE AVE., CHICAGO 14
50 YEARS OF SERVICE TO INDUSTRY

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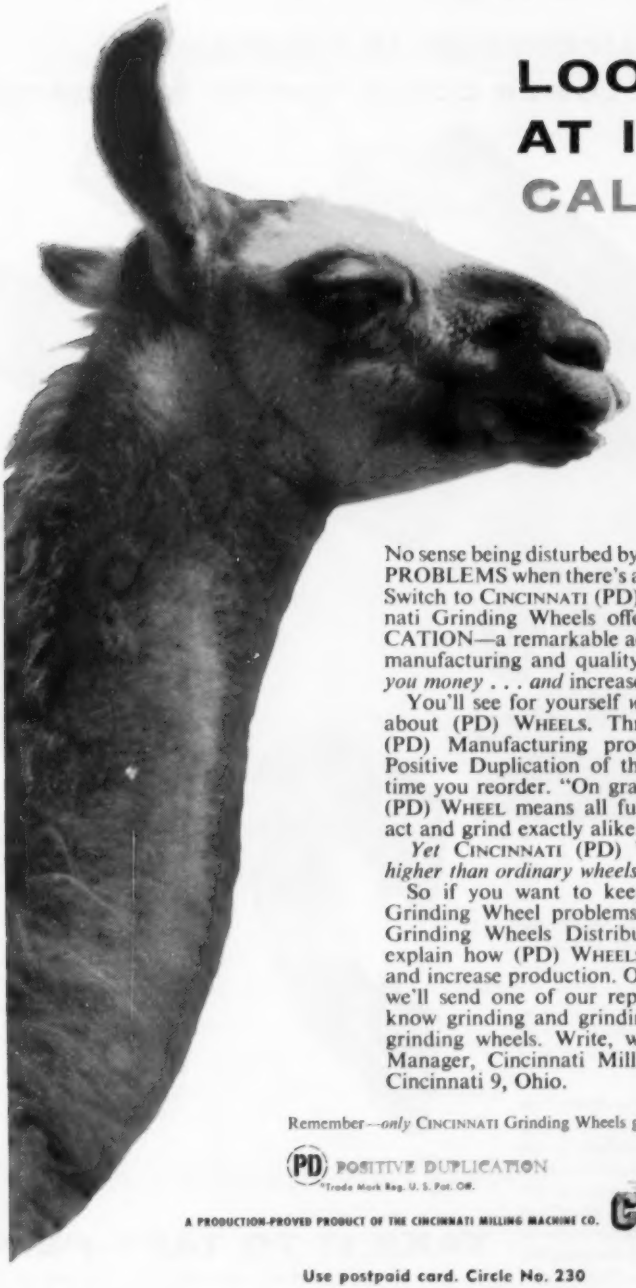

LOOK AT IT CALMLY

No sense being disturbed by GRINDING WHEEL PROBLEMS when there's an easy solution in sight. Switch to CINCINNATI (PD)° WHEELS. *Now* Cincinnati Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that can *save you money . . . and* increase your production.

You'll see for yourself *why* everybody's talking about (PD) WHEELS. Through the CINCINNATI (PD) Manufacturing process you are assured Positive Duplication of the original wheel every time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

So if you want to keep calm in the face of Grinding Wheel problems, see your CINCINNATI Grinding Wheels Distributor. He'll be glad to explain how (PD) WHEELS can save you money and increase production. Or, contact us direct and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

Remember—*only* CINCINNATI Grinding Wheels give you

(PD) POSITIVE DUPLICATION
°Trade Mark Reg. U. S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

CINCINNATI Grinding Wheels

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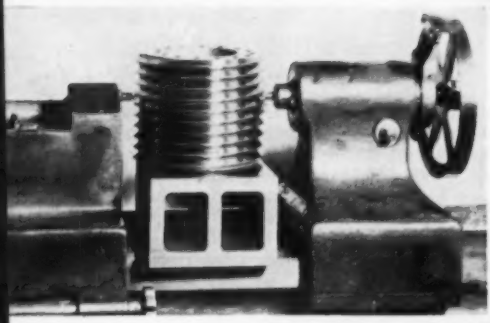
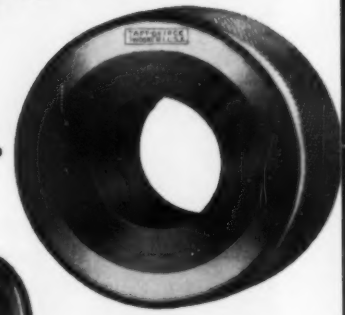
Taft-Peirce gives three ways to...

PUT EXTRA "LIFE-VALUE" IN YOUR GAGING FOR LOWER COSTS, HIGHER STANDARDS





Taft-Peirce offers one-source selection of four special materials which make your gaging dollar go much further.

Electrolized, Carbide, Norbide, and chrome plating have characteristics which greatly extend gaging accuracy and wear under different conditions. Electrolized, for example, means the gage has an even film of hard, tough non-magnetic alloy — only .000025" thick — on all gaging surfaces, providing an exceptional wear resistance.

Get Taft-Peirce extra "Life-Value" on your next order. If you want to reduce gaging costs — and promote higher standards at the same time — Taft-Peirce will be glad to use its experience to recommend special surface or material selection. This T-P extra "life-value" will more than pay for itself . . . in better parts inspection and smarter gage buying. For complete listing and prices of Taft-Peirce Fixed Gages, ask for The T-P Handbook.

ELECTROLIZED

A & B. Limit thread plug gages and cylindrical plug gages are available with individual handles or double-ended. Furnished in Taper Lock, Trilock or Reversible design. Bonus value comes from extreme surface smoothness which reduces friction. Also highly corrosion resistant.

CARBIDE AND NORBIDE

C. All types of cylindrical plug gages can be furnished from Norbide. Extreme hardness imparts long wear resisting qualities.

D. Norbide Ring Gages are particularly suited for accurate inspection of highly abrasive materials or large quantities of parts.

E. Adjustable Snap Gages can be furnished with gaging members faced with tungsten carbide, tantalum carbide or Norbide for extra wear resistance.

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THE TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, R. I.

T-P Means TOP Precision

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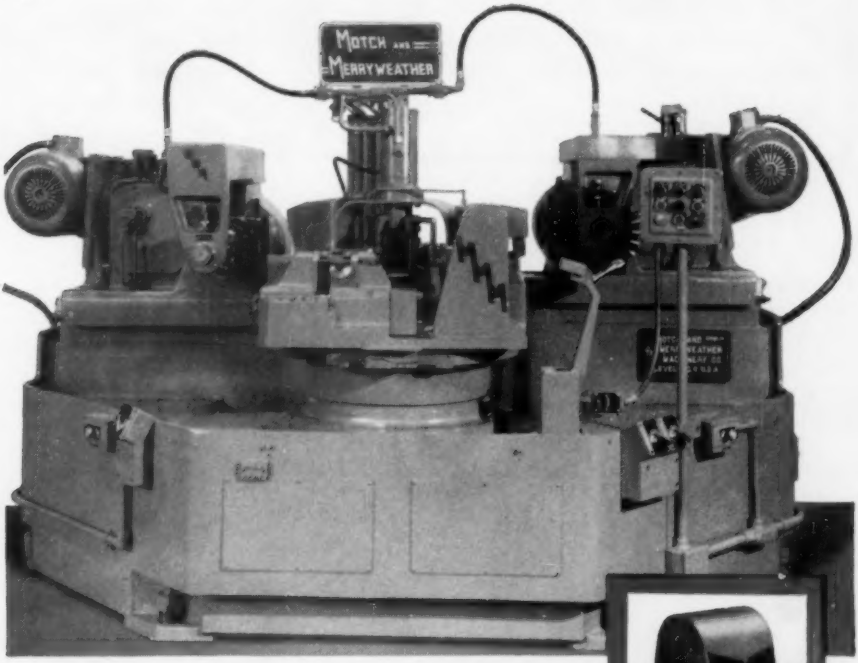
Another specialized machine by M & M



Special duplex milling machine

for milling and slotting chain links

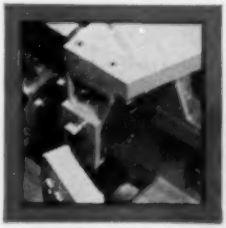
Operation—Straddle and form mill on right hand station, slot or straddle mill on left hand station.

Universal—Six different sized parts run over this machine.

Cycle—Either automatic or manual cycle. Cycle time, 64 seconds.

Feed—Custom-designed and built hydraulic head feed, index and clamp.

Fixtures—Four fixtures are mounted on index table.



Heavy welded steel construction, annealed milling head and rugged, all-helical gear train in heads assure continuous production with a minimum of maintenance and costly downtime.

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Company

MACHINE TOOL MFG. DIVISION
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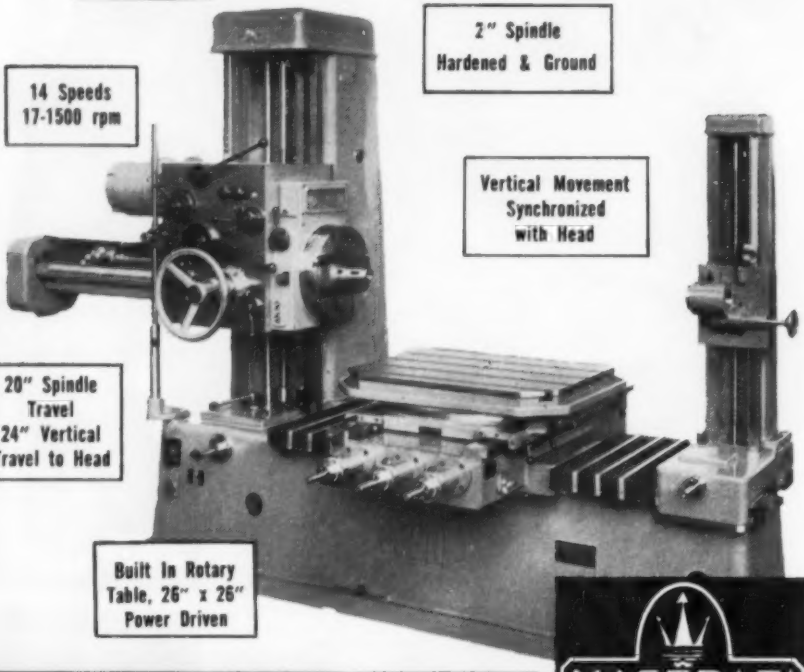
FLEXIBILITY!

Designed for **HIGH PRECISION** light machining within .0005" overall accuracy

PAMA

HORIZONTAL BORING, MILLING & DRILLING MACHINE

Model #AL-55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2" Spindle Hardened & Ground
14 Speeds 17-1500 rpm
Vertical Movement Synchronized with Head
20" Spindle Travel 24" Vertical Travel to Head
Built In Rotary Table, 26" x 26" Power Driven

- power feed in all directions
- rapid traverse
- optical measuring system available
- thread cutting attachment available

Complete with standard equipment price **$10,920**

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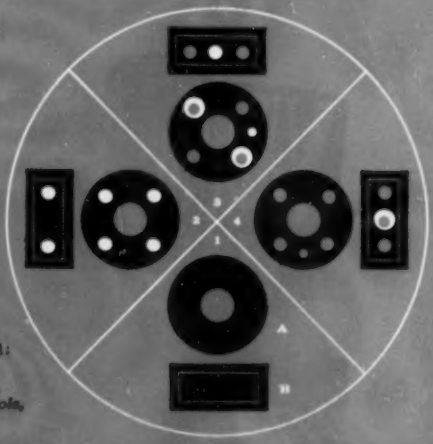
Natco Naturals

Cost-Cutting Ways
You Can Use
Standard Multi-Spindle Natcos

Any time your parts require machining *more than one hole*–drill, bore, face or tap–it may well be a "Natco Natural." Your standard Natco will produce substantial savings in a surprising number of situations, *even in small job-shop lots!* Call in your nearby Natco field engineer; he'll tell you in short order whether you've got a "Natco Natural" there.

Multiple Drilling Operations on Two Part-faces

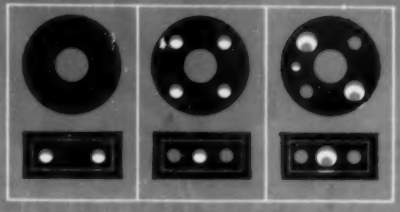


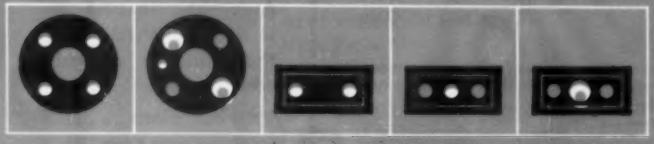
130 parts per hour–4-position rotary table. POSITION #1: *Unload finished part, transfer half-finished part, load new part.* POSITION #2: *Drill 4 holes, Face A. Drill and countersink 2 holes, Face B.* POSITION #3: *Drill 1 hole, ream 2 holes, Face A. Drill 1 hole, Face B.* POSITION #4: *Trepan 1 hole, Face B.*

68 parts per hour–stationary fixture *with 5 work locations. Operator transfers parts after each stroke. One part completed per stroke.*

40 parts per hour–straight-line indexing. *After every 3 strokes, operator unloads finished part, transfers half-finished part and loads fresh part.*

23 parts per hour–tumble-type fixture. *Operator transfers and tumbles fixture from one position to the next. One part completed every five strokes.*





Standard multi-spindle Natcos range from 1 hp, 10-spindle machines to 50 hp machines with up to 72 spindles. Spindles in standard Natcos are driven through universal joints and located by either adjustable arms of bored slip plates

NATCO

National Automatic Tool Company, Inc.

Richmond, Indiana

Multi-spindle drilling, boring, facing & tapping machines. Special machines for automatic production.

Call Natco Offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland, Los Angeles; distributors in other cities.

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PROVED SAVINGS UP TO 75%

IN SET-UP AND GRINDING TIME WITH CONTINUOUS WORK INSPECTION AND INFINITE PRECISION

SIMPLIFIED OPERATION

When working with TUNGSTEN CARBIDE, STAINLESS STEEL, STELLITE or TOOL STEELS, VISUAL GRIND permits a semi-skilled operator to grind precision pieces without continued checking with the comparator. Automatic inspection is accomplished with the built in optical comparator.

Visit our plant . . . let us show you how VISUAL GRIND will speed production — cut costs.

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Gentlemen:

- ☐ Please have your representative call at our plant. The most convenient time would be (week) _____
- ☐ Phone for appointment
- ☐ Please send us complete information on the new VISUAL GRIND.

NAME _____ TITLE _____

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SHELL IRUS FLUID 902

the low-cost, fire-resistant hydraulic fluid

Factory Mutual Laboratories, the well-known industrial testing authority, recently evaluated Shell Irus* Fluid 902.

The tests performed included:

1. **Flash Point**
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The Shell Industrial Engineer can give you more information about these tests.

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In plant after plant, users find that Shell Irus Fluid 902 is comparable in fire resistance to much higher priced hydraulic fluids.

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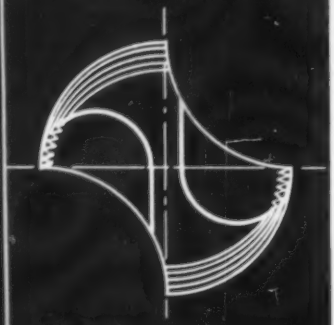

Chips flow freely, since chip driver contours are always of exact size, shape, and position.

BALANCED ACTION TAPS
cut clean—always!

When you know that a tap has been manufactured with great care and skill—you're assured of closely controlled hole size and long tool life. Only Winter makes taps with Balanced Action. They give clean-cutting performance—*always*.

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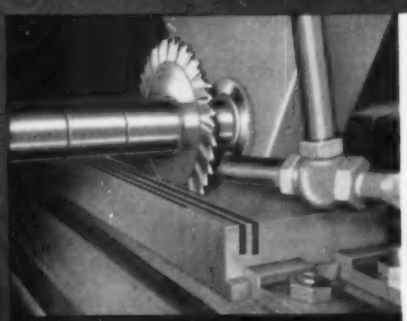

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Finding the best way to do a deep-slotting job in the National research laboratory.

National will have the right one

National's complete line of tools can save you time and tool-life. For instance—just tell National about your sawing or slotting job. You'll get a tool that is sized, styled, and designed to do the best job.

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A job-proved Heller line
Heller
solid carbide
Tools
give more because they "give" less!
GREATER RIGIDITY PAYS OFF: There's no spring or wobble as with carbide-tipped steel tools. So, longer life, higher speeds and smoother finishes are built into Heller Solid Carbide Tools.
CHECK THESE SPECIFIC ADVANTAGES! Heller Solid Carbide End Mills produce much finer finishes than tipped types. Heller Solid Carbide Drills increase production 40 to 50 times over high speed steel drills because of higher speeds. Heller Solid Carbide Reamers last as much as 50 times longer than steel reamers cutting hardened steels at Rockwell C-63.
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Heller gives you more than good tools to sell. You get selling ideas that make Heller Tools seem different and better. You get fact-packed advertising support that makes your selling easier. Just what you'd expect from the tool manufacturer that's oldest in filing experience ... newest in cutting developments.
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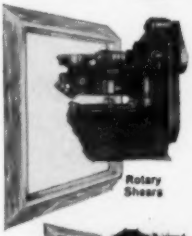
SHEAR, PUNCH AND COPER

Its Magic Performance Can Win You Many "Production Oscars"

This "jack-of-all-jobs" will do the work of a half dozen machines, yet it does not take up any more floor space and represents very little more investment, than a shear or punch, or any other single-purpose machine.

Here is another production-boosting and cost-cutting feature: with this versatile machine two men, working on each side of the machine, can turn out the same or totally different jobs, at the same time! Enables you to double output, using your present staff.

Available in 3 sizes for light, medium or heavy work. Kling Combination Shear, Punch & Copers are speeding production and cutting costs "in the best of companies." Write us for names of some of these firms in your industry—and also for a copy of the New Kling Combination Bulletin No. 347-A.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Since 1892

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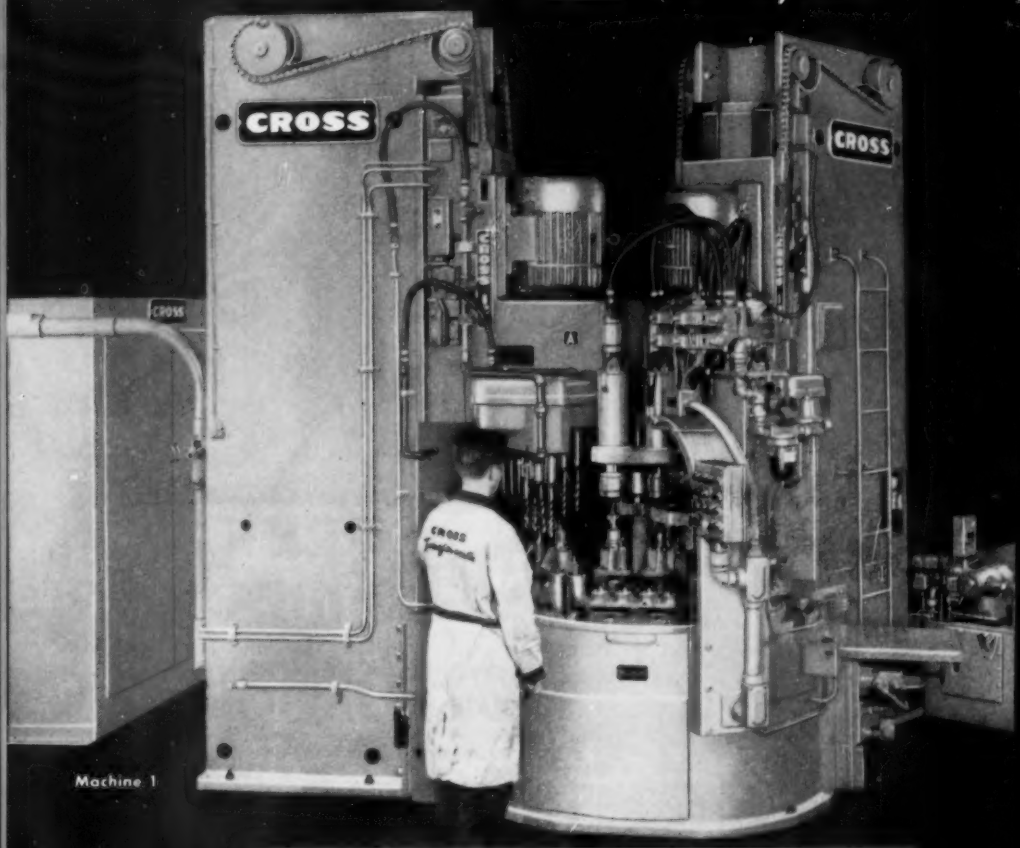
Established 1898

THE CROSS CO.

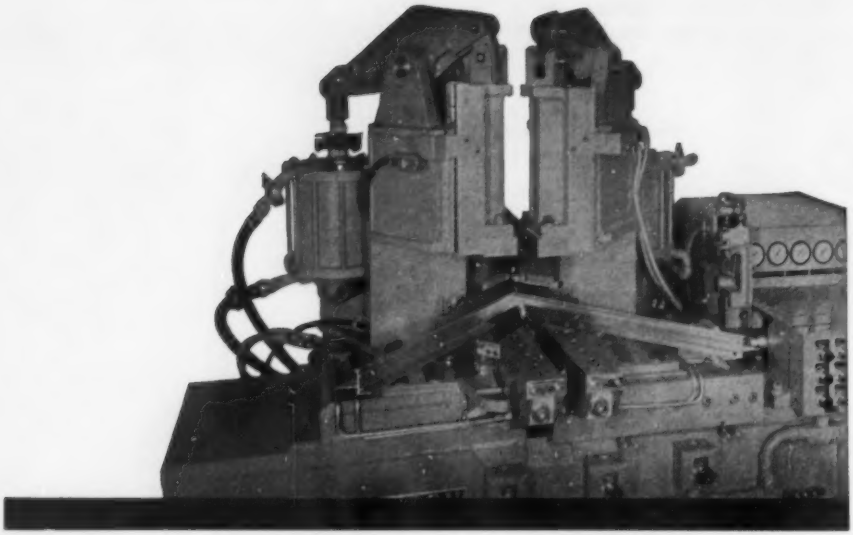
First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN



Machine 1

- ★ 800 pieces per hour at 100% efficiency.
- ★ Four parts machined in each station.
- ★ Machine 1 drills and reams rocker shaft hole; forms oil groove; drills one oil hole. Machine 2 drills, chamfers and taps adjusting screw hole; drills, counterdrills and spotfaces second oil hole.
- ★ Push button controlled power wrenches operate fixture clamps.
- ★ Cross "building block" construction provides flexibility for part design changes.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for drilling and reaming; individual lead screw feed for tapping; automatic lubrication; pre-set tooling throughout.



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PRK • 33 TOOL STEEL

(Cobalt, High Carbon, High Chrome)

***Holds its edge at 1000° F.!**

Above is the Thomson Synchro-Matic Flash Welder performing a miter weld on an aluminum window extrusion. "Pinch-off" dies of PRK-33, a Thomson development, support the work close to the point of weld. After welding, this PRK-33 die moves in to pinch off the flash close to the surface of the work. Eliminates most cleaning and finishing of the weld.

After testing many die steels, Thomson now specifies PRK-33. They have found PRK-33 to be the finest high carbon, high chrome, with cobalt, die steel available. Its production record, its ability to hold a hard edge at high temperatures far surpassed all other die steels tested. Heat treated and double drawn at 980°F. gives PRK-33 a secondary hardness of 59-61 Rc.

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Complete Line of highest grade Tool Steels, including PRK-33, DARWIN No. 1, NEOR, MINEOR, OHT, "MT6" and various grades of Hot Work Specialty Steels. Furnished in Bar Stock, Forgings, and Sand Castings, Drill Rod, Flat Ground Stock and Tool Bits.

Bulletin on Request.

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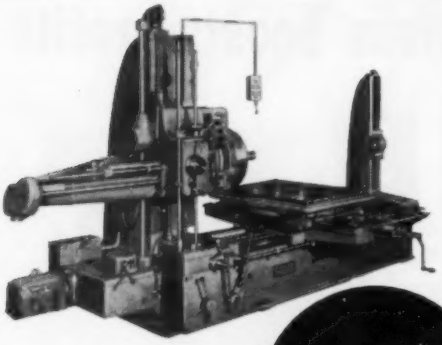

TABLE TYPE

BFT - 80
3⅛" spindle diameter
Base price $18,880.

BFT - 100
4" spindle diameter
Base price $32,975.

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5" spindle diameter
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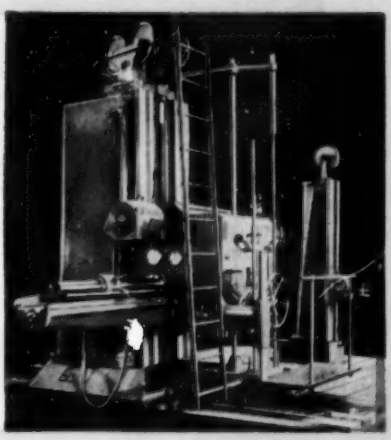
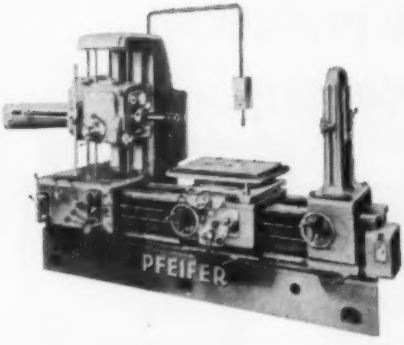
IMPERIAL

Power-saving drive ensuring full utilization of carbide-tipped tools. Very wide range of speeds and feeds to take care of all imaginable machining problems for smallest and largest working diameters. High-quality design of the bearing system for the inner and outer hollow spindle driven independently. All operating elements are neatly arranged, avoiding complicated switch-gear susceptible to trouble. Small manufacturing tolerances due to precision-scraped or ground guide-ways and highest accuracy of setting either by dial gauges or optical instruments.



FLOOR TYPE
BFP - 160
6¼" spindle diameter
Base price $47,880.



SPINDLE HEAD—The spindle head is of rugged and compact construction.

TURNING—High degree of flexibility. Employed as a standard lathe and a facing lathe.

OPTICAL POSITIONING—The optical measuring equipment used in this machine furnishes readings easily and is easily understandable for the operator.

ACCURATE POSITIONING BY DIAL AND GAUGE BLOCKS.

TABLE—Rotating square, rotary table can be turned for one complete revolution.

MULTIPLE LENGTH AND CROSS FEED STOPS.

MODEL FO
Base prices from $9,988.

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RENTAL PLANS

See page 22.

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Three ways Multipress® boosts profits

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Better quality. Rejects have been virtually eliminated for this toy manufacturer. Easily broken plastics and intricate electrical relays are assembled quickly, accurately with Multipress.

2

Lower costs. Specialty manufacturer reduced cost of pepper mill assembly from 15¢ to 4¢ per unit by using Multipress equipped with simple interchangeable tooling.

3

Adapts to any job. Special tooling on this 4-ton Multipress made it possible to mass-produce the point for a cartridge-filled pen. Blanking, piercing and stamping are performed with one Multipress ram stroke.

Let Multipress point the way to production economy

DENISON HydrOILics

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DENISON ENGINEERING DIVISION

American Brake Shoe Co.

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HYDRAULIC PRESSES, PUMPS, MOTORS, CONTROLS

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Switch to lowest-cost parts duplication with

CINCINNATI HYDRAGUIDE TRACER LATHES

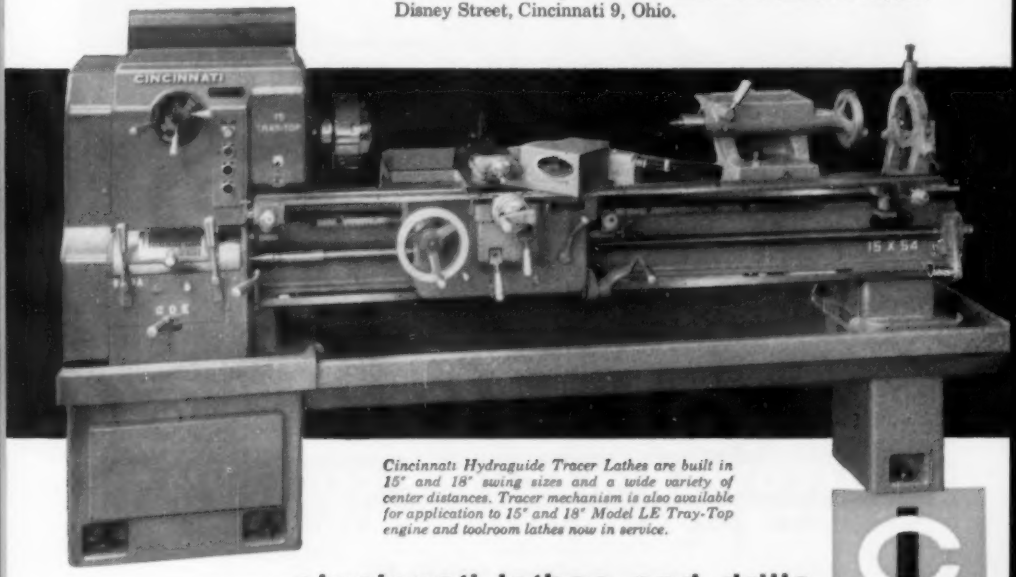
"Head of the Class" Engineering—

Compact design provides shortest hydraulic linkage for more sensitive control . . . requires no additional floor space. Tool is accurately guided by sensitive stylus following the easily-accessible flat template. Automatic duplication . . . less operator attention . . . lowest tooling cost . . . minimum tool setting . . . less scrap . . . lowered cost per piece!

Just push this button to provide lowest-cost tracer machining on these new Cincinnati Hydraguides® . . . yet there is no interference with standard lathe operation. Everything is on the carriage, but nothing is in the way. All controls, template and tool are on the operating side for maximum convenience.

All the proven Tray-Top features are included, of course . . . PLUS an increase to 5 HP for even greater performance. Here is NEW versatility . . . NEW convenience . . . NEW profit possibilities. And it's *still* an ECONOMY-PRICED lathe!

Ask your C L & T Dealer for the Hydraguide story. Write today for full data—catalog H-150. Cincinnati Lathe and Tool Co., 3207 Disney Street, Cincinnati 9, Ohio.



Cincinnati Hydraguide Tracer Lathes are built in 15" and 18" swing sizes and a wide variety of center distances. Tracer mechanism is also available for application to 15" and 18" Model LE Tray-Top engine and toolroom lathes now in service.

center on **cincinnati lathes and drills**

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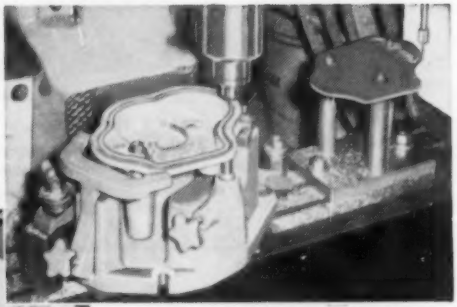
SINCE 1933

The Most Dependable TRACER CONTROLS

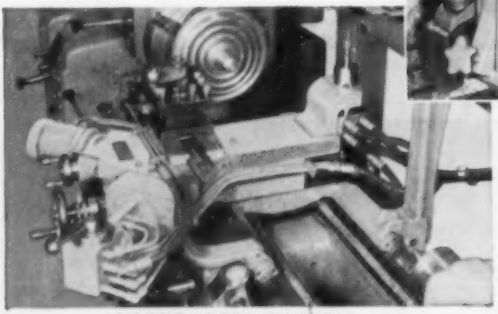
SPECIFIED AS ORIGINAL EQUIPMENT BY LEADING MANUFACTURERS OF MACHINE TOOLS

TURCHAN EQUIPMENT IS ADAPTABLE TO MOST MACHINE TOOLS *without* INTERFERING WITH MANUAL OPERATION

Modernize your standard machine tools with Turchan hydraulic tracer attachments. Enjoy the extra profits possible with precision automatic production equipment.



MILLING APPLICATION



LATHE APPLICATION

Produce at greater speed, a higher degree of accuracy without frequent "miking" and reduce rejects. Any machine operator can handle intricate profile or contouring jobs with Turchan tracers.

New literature is now available on Turchan products. Turchan field engineers are happy to talk to you. Write or call today. There is no obligation.

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FOLLOWER MACHINE COMPANY

P.O. BOX 6055, DEARBORN 9, MICHIGAN

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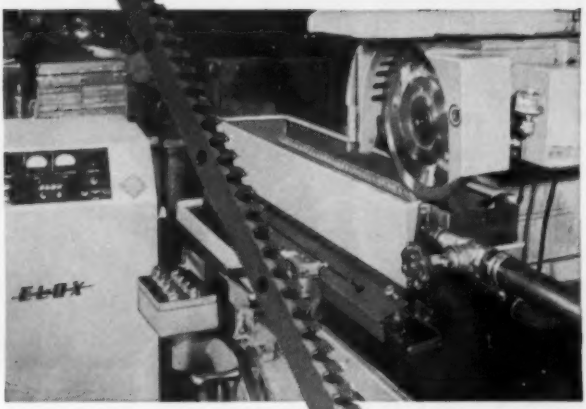
"elox saves us $294
... 8 operations
form grinding this broach"

Ford Motor Aircraft Division



Savings on preformed carbide blanks	$ 32.00
Omitted operations savings	120.00
Diamond wheel savings	142.00
Sums up to	$294.00

The Job...
Broach, used for broaching the pine tree form on turbine blades of the J-57 Jet engine.

NO DIAMOND WHEEL...

EDM substitutes inexpensive brass wheels costing less than $45 for expensive diamond wheels costing a minimum of $150. Brass wheels are formed for $1 as against a diamond wheel contour forming cost of $35.

NO PREFORMED CARBIDE BLANKS...

Conventional machining necessitates preformed tungsten carbide and preformed steel shanks. EDM machines the carbide, brazing material and steel simultaneously, and requires no indexing to assure a perfectly formed broach as to location and size.

OPERATIONS...

Conventionally machined, the pine tree broach requires 22 operations. EDM does it better in 14.

Electrical Discharge Machining has reduced the machining time of this intricate form in 32 carbide tipped teeth to a total time cycle of 33 minutes . . . one-half the time of abrasive grinding. Tolerances held to: +0, —.0002".

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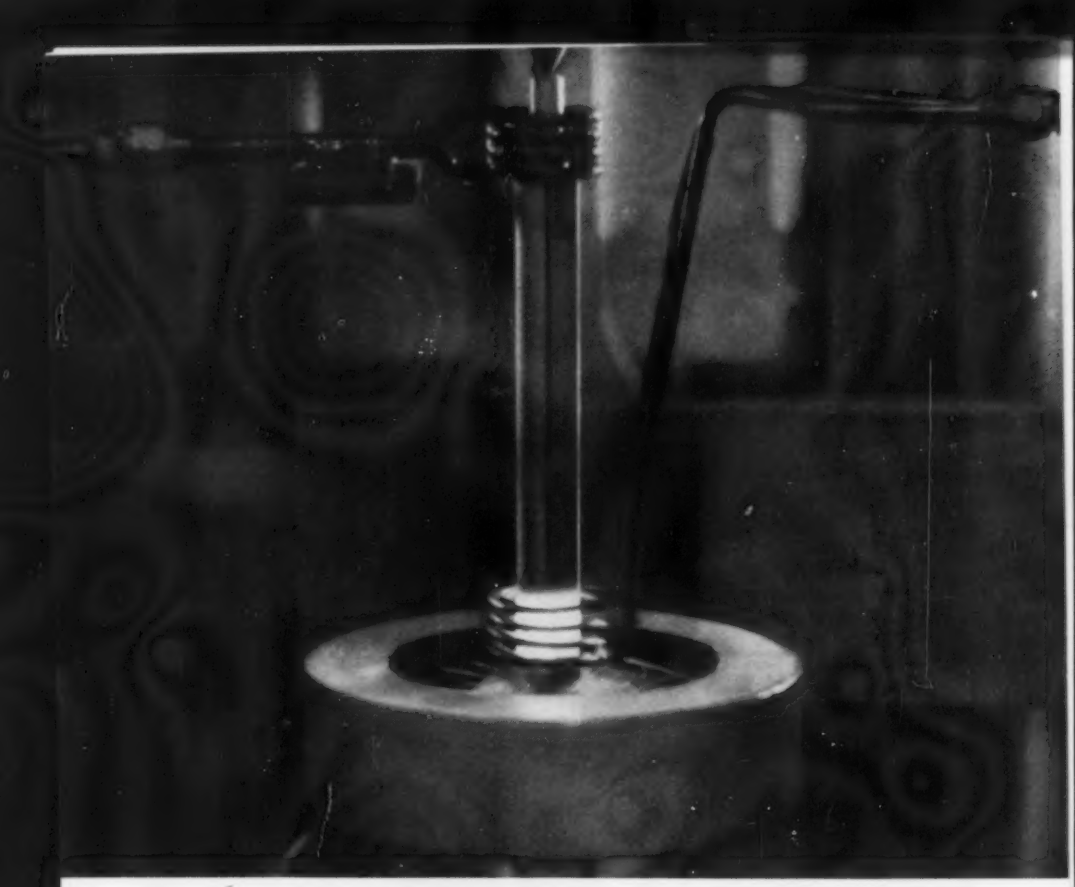

Ketos shaft being induction hardened to Rockwell 55-56, while ends remain soft for final machining.
Photographed at Control Instrument Co., Inc., Brooklyn, N. Y.

KETOS has wide hardening range with minimum volume change...

Ketos is a low priced alloy tool steel that can be hardened from low temperatures with practically no volume change. It has deep hardening qualities, and a fine grained structure, that make it desirable for many production parts.

That's why nondeforming Ketos is well suited not only for most tool steel applications such as gauges, dies, and taps but also for close-tolerance, wear-resistant parts like the actuator bar shown in the induction heating unit above. The thin contact edges of this particular part withstood a "life test" of over 4-million high speed blows. No other steel tested lasted more than 1-million cycles before it chipped and failed.

If Ketos sounds like the steel you should be using, call your nearby Crucible warehouse. Stocks of Ketos and dozens of other special tool steels are large, delivery fast. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

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he **HAD** to use a hand brace!

but **YOU** can use a Buckeye Air Tool!

Drilling ten or a thousand holes an hour . . . in metal, woods or plastics . . . is faster, safer, easier and cheaper if you're using a modern Buckeye air drill. You'll do better work, too, because you can concentrate on accuracy, letting the Buckeye tool do the muscle work. There's a complete range of drills listed in our Catalog A-10—may we send you a copy?

Buckeye "A" Series drill, with offset handle, being used on an aluminum drilling operation. Clips hold panels in position after holes are drilled.

Why AIR Tools?

Because air is everywhere, just waiting to be put to work . . . because continuous operation can't possibly harm an air tool . . . and because, using Buckeye air tools, you can almost forget about tool maintenance.

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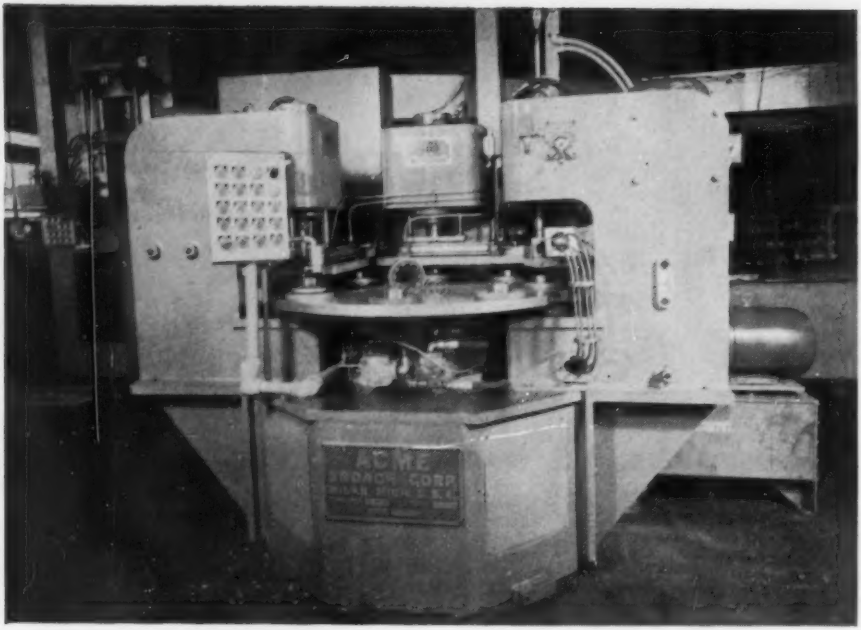

Acme Automated Assembly

incorporating standard press units

Shown above is a special unit utilizing three standard type Acme Hydraulic Bench Presses, a special base unit and large diameter eight-station rotary hydraulic index table recently supplied a foremost automobile manufacturer. This unit was designed and built by Acme for pressing formed bushings into automatic transmission components and then pressing a burnishing ball through the complete assembly in order to size the ID of the bushings and assure required finish. Bushings are magazine fed and operator merely places the major component into fixture bushing and removes completed assembly. Unit produces at the rate of 300 completed parts per hour.

Contact Acme today for help on your broaching, broach tooling and press problems. No obligation.

ACME BROACH CORP.

MILAN, MICHIGAN

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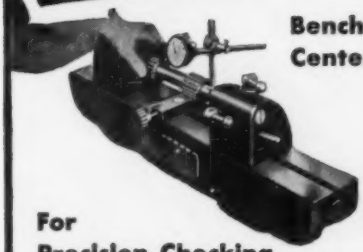
Time Saving Production and Checking Accessories

Here are three Sundstrand accessories that may prove helpful in your work. A wide range of bench centers and balancing tools are available for checking purposes. The automatic index base has proved a sound addition to many metal working machines. Write for further information.



Bench Centers For Precision Checking

Simplify assembly, lower spoilage and get better production from this modern Sundstrand Bench Center. You'll check work between centers easier, faster and within limits of .0001" on this improved Sundstrand Bench Center.

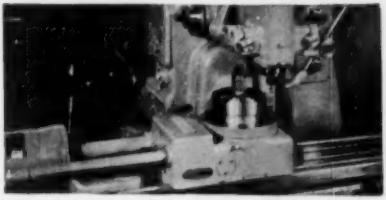
COMPLETE RANGE AS FOLLOWS:

6" x 18"	12" x 48"	24" x 48"
6" x 36"	12" x 60"	24" x 60"
12" x 36"	12" x 72"	24" x 72"

Balancing Tools For Small Medium or Large Work

Sundstrand offers a complete line of balancing tools which will save their cost quickly on truing or balancing operations. Accurately sensitive and durable, they provide a simple, reliable means for checking the balance of parts like gears shafts, fly wheels, pulleys, etc. Standard swing sizes range from 21 inches up to any swing desired. Length between standards ranges from 20 inches to any length desired.

Automatic Index Base For More Production



This automatic index base is designed so there is no strain against the index plunger during the cut. The base is locked by powerful clamping so that accuracy of index is not affected by heavy cuts.

In many cases, the addition of this Automatic index base has increased milling production enough to eliminate need for the purchase of additional machinery. It may be the answer to your milling production requirements. Call in a Sundstrand engineer. There is no obligation for this.

Free Data

Complete specifications are available on these three time saving accessories. Write for your copies today. Ask for bulletin 481.

SUNDSTRAND

SUNDSTRAND MACHINE TOOL CO.

2535 ELEVENTH ST. ROCKFORD, ILLINOIS, U.S.A.

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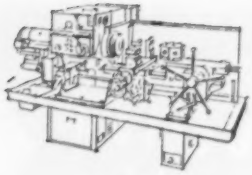
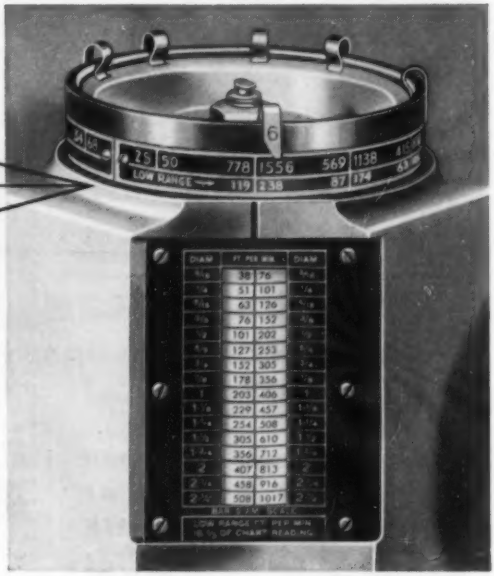


If you

were a turret lathe operator today, wouldn't **you** want to work at a machine with this easy method of preselection?



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save money because:

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choose from these
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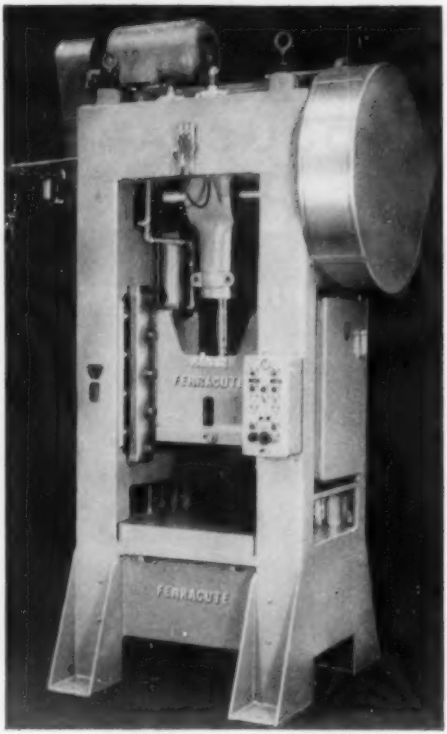

Ferracute Press S-1-150-27-33 150 tons

Also adaptable to bending, blanking, forming, piercing, shearing, and stamping applications. The S-1 presses accommodate practically any automatic or semi-automatic feeds. They have as standard equipment the new Ferracute friction clutch—air-powered, electrically controlled—with interconnected brake and single-point adjustment.

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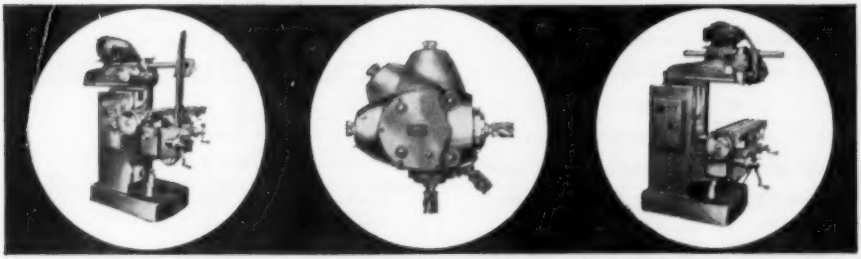
Ram type miller

No. 16S — The most versatile miller available — features the quill type adjustable cutterhead that permits horizontal, angular and vertical milling plus boring and drilling. Table: 40½" x 10"; Quill Travel: 4"; Quill Power Feeds: .0015; .003; .006; Cutterhead Spindle Motor: 2 HP; Speeds: 110 to 3600.

A single investment in ONE Van Norman ram type miller gives you the equivalent of two single purpose machines plus attachments. And at a much lower cost.



No. 16M — a heavy duty miller designed for maximum rigidity and accuracy. Table: 40½" x 10"; Ram Travel: 20¼"; 3 HP Cutterhead Spindle Motor; Speeds: 50 to 2000.

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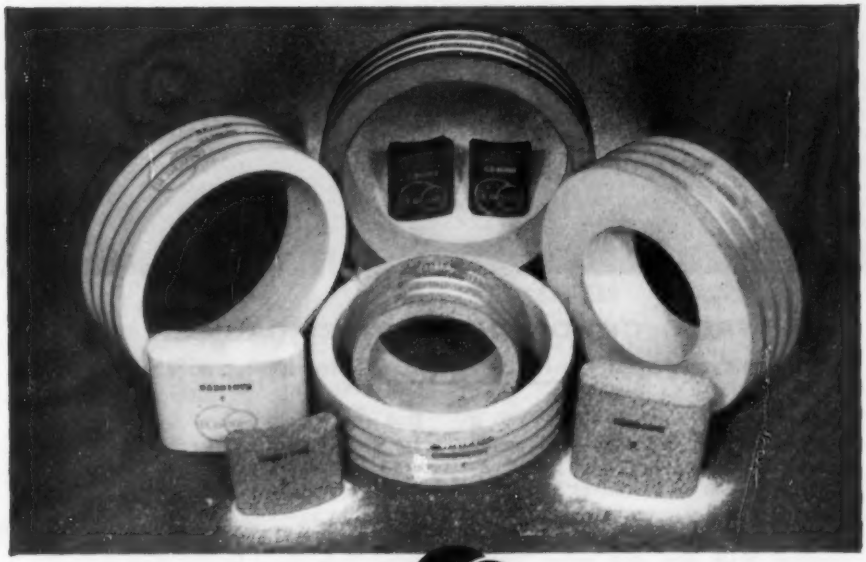

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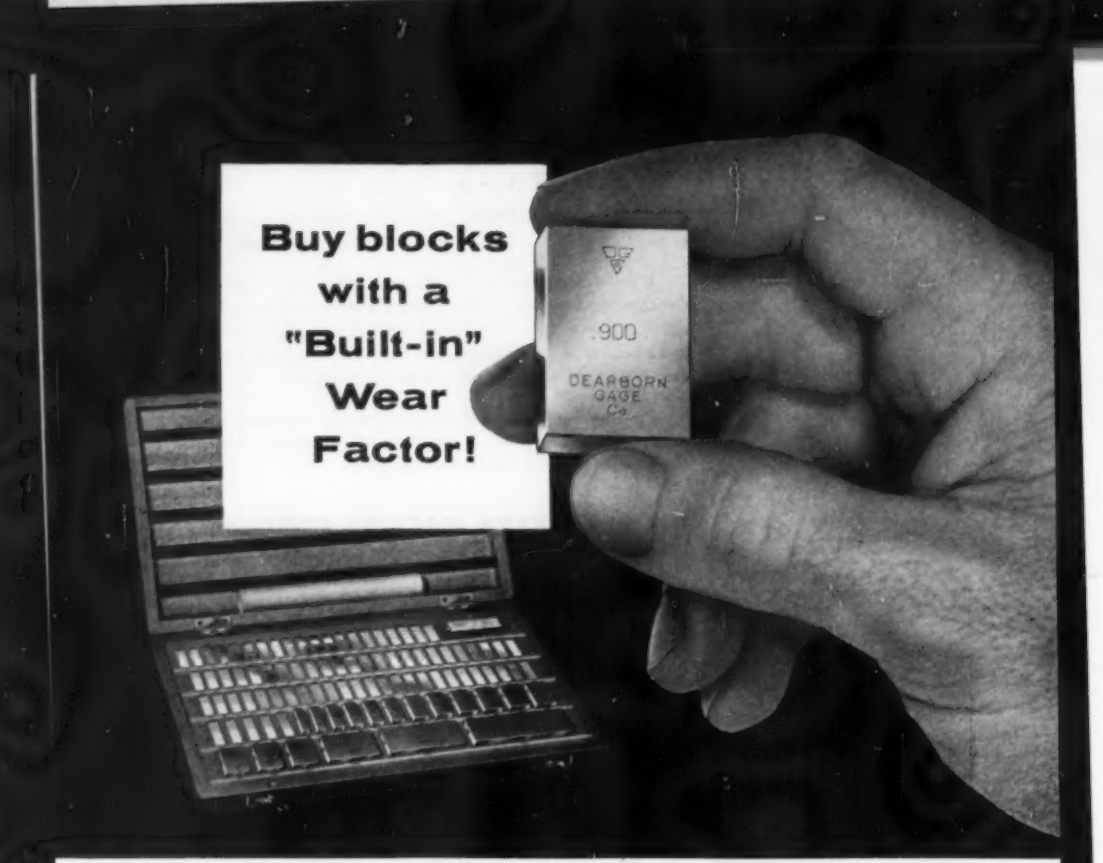

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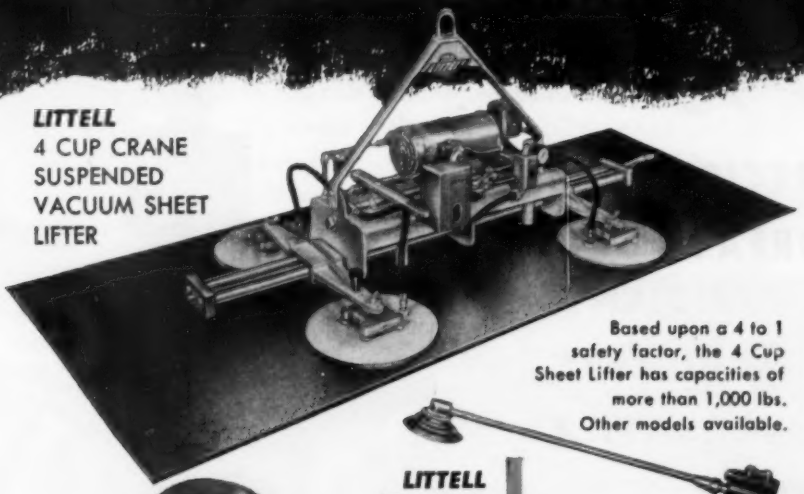

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Based upon a 4 to 1 safety factor, the 4 Cup Sheet Lifter has capacities of more than 1,000 lbs. Other models available.

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Automatic ejection of pieces by using a short blast of air permits the operator to give his entire attention to loading the die, thereby saving time and increasing output.

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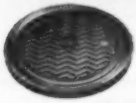
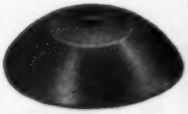
LITTELL VACUUM CUPS



14" diameter herringbone faced cup with neoprene rubber.▲



Rectangular cups with neoprene rubber molded on steel backing plate. Sizes 2½" x8¾" and 3½" x16".

Molded on steel backing plate equipped with 4 mounting holes. Other designs for 6 to 10" diameter available. ▼

Standard cups in neoprene or gum rubber sizes ¾" to 5".

▼As shown in top illustration. ▲As shown on Pres-Vac.

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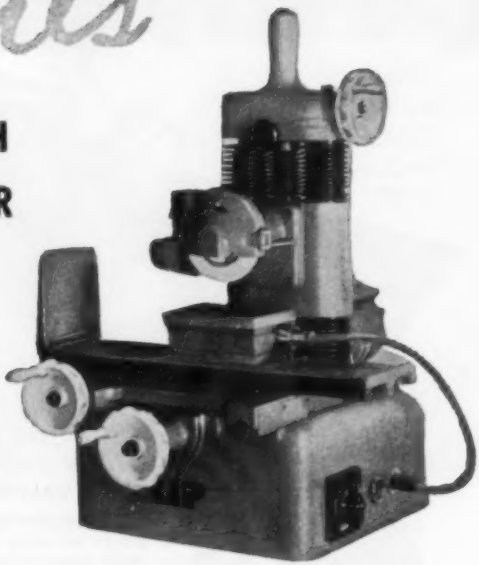

This compactly designed surface grinder is especially adapted for the precision dry grinding of small parts: dies, tools, gauges and instrument components. The low-cost LIP surface grinder permits the spot use of a number of machines strategically located throughout the plant. Features: Automatic spindle play take-up; precision ball bearings, counter balanced grinding wheel, bellows for dust protection.

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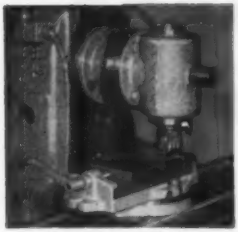
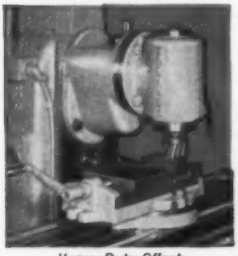
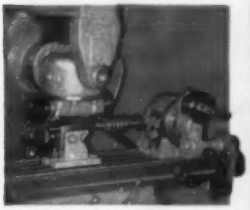


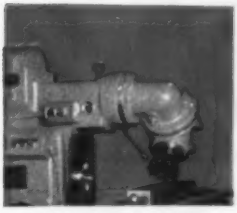
Heavy Duty Vertical Milling Attachment



Heavy Duty Offset Vertical Milling Attachment



Universal Milling Attachment



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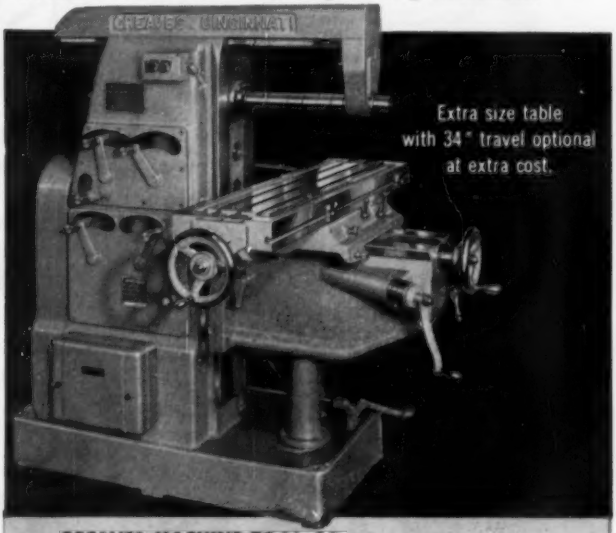

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They made 1 wheel

Working with foreman Bill Todd (right) of Whitin Machine Works, Whitinsville, Mass., Bay State distributor, Vic Ericson (left) of Johnson deVos, Worcester, Mass., helped cut Whitin's grinding costs thousands of dollars per year.

do the work of 12

Centerless grinders at Whitin Machine Works were handling parts 1/8" to 5" diameter in bronze, brass, aluminum, cast iron, Meehanite and various steels. Short runs averaged between 3 and 300 pieces. With a dozen different wheels in use, the opportunities for savings on wheel changes alone were tremendous.

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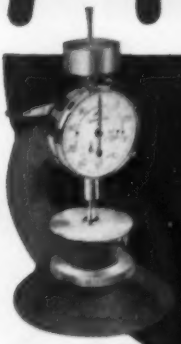

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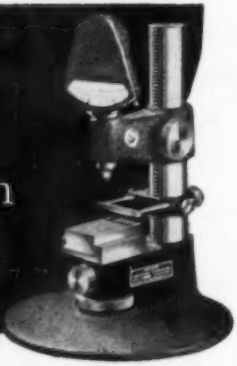

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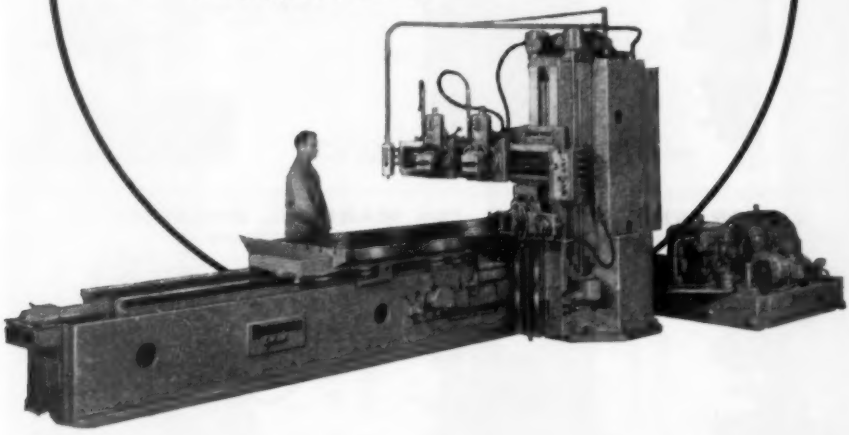
A Rockford Machine Tool Co. representative can demonstrate these advantages for you. Ask your local dealer for full details, or write us for a copy of Bulletin No. 1200.



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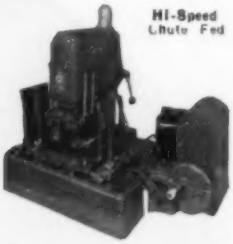

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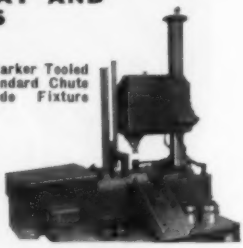
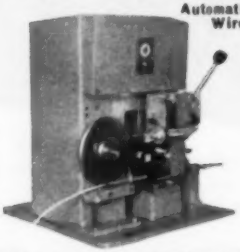
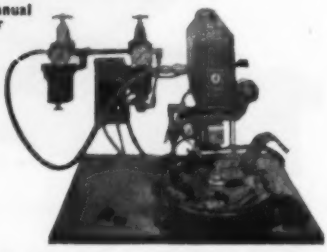


FOR WIRE MARKING, INK MARKING, BRANDING

Ink Marker



Automatic or Manual Wire Marker



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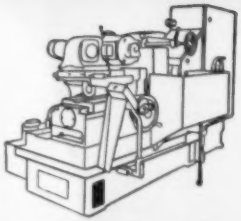

HEAVY DUTY TYPE 914
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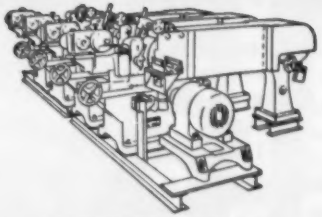

HIGH SPEED TYPE 101
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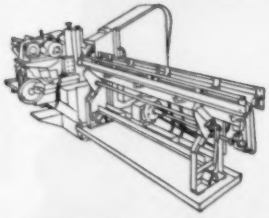

MEDIUM DUTY TYPE 614
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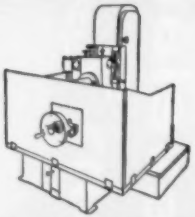

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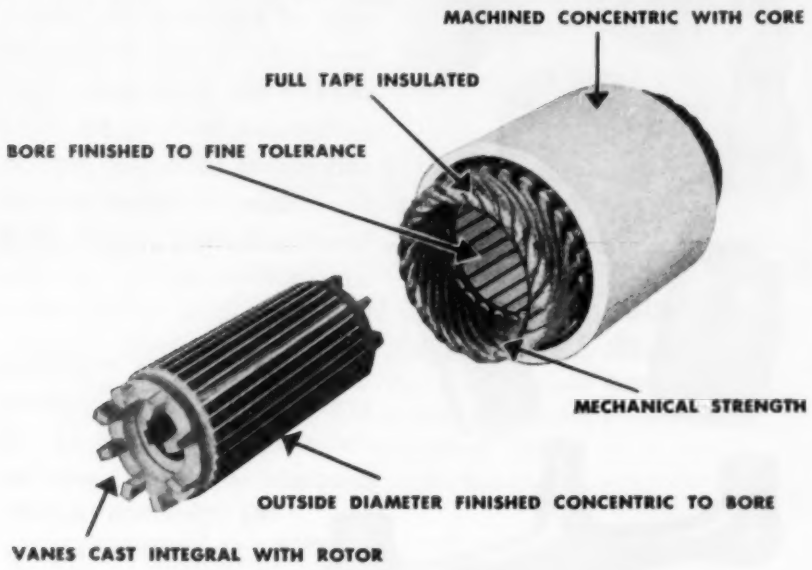
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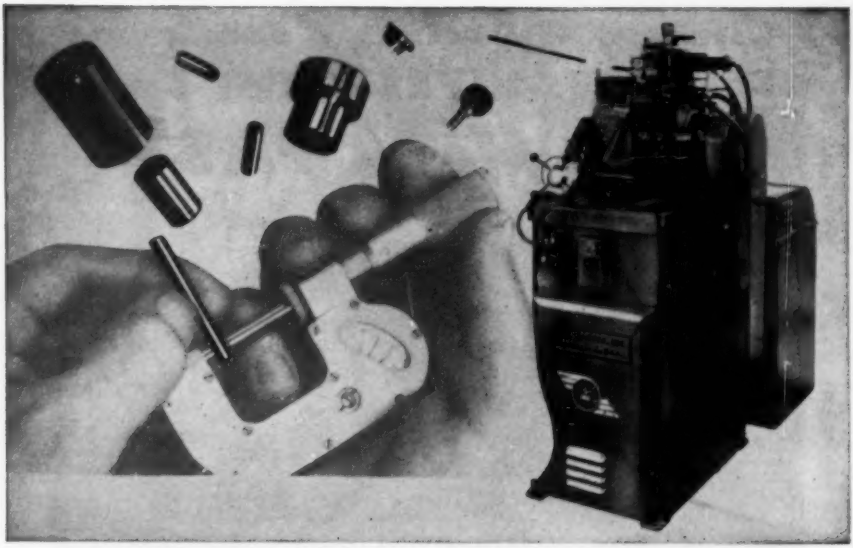

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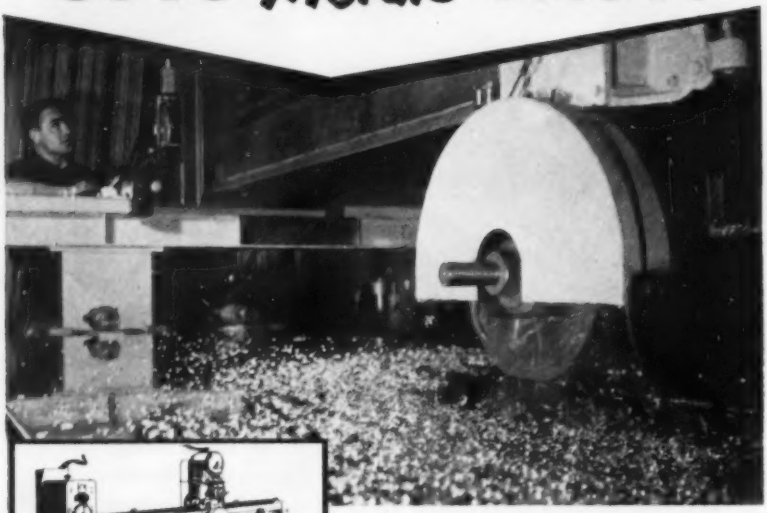

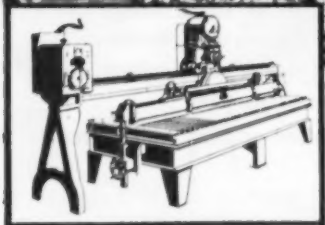

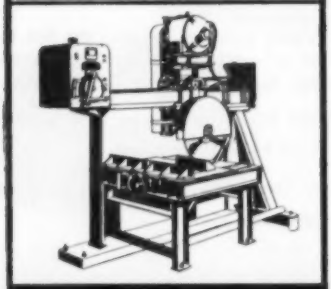

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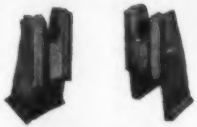
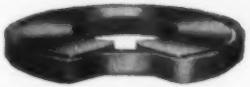


Columns



Circular Base Top

Index Table Support

Pedestals

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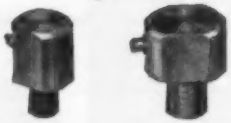

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Features This Month

MACHINE AND TOOL **blue book**

CONTROLS AND ADVANCED MECHANIZATION REPORT

1. **The 'How' and 'Why' of Numerical Control—Page 111**
2. **How Chevrolet Produces Pinion Gears on Integrated-Interlocked Line—Page 130**
3. **Producing Transmission Housings at Chevrolet —Page 148**
4. **Building Parts for Stock—Not Specific Orders—Page 162**
5. **How a Small Operator Makes Mechanization Pay Off—Page 170**

What's Ahead for Automation? In a 7-page interview by Ralph E. Cross as told to Paul A. Meline, managing editor, this well known manufacturer of automation machinery discusses the building block concept, training procedures for maintenance people, mechanization of inspection, where automation equipment is justified and other pertinent facts bearing on the present and future status of automation machinery. ..... **Page 103**

The 'How' and 'Why' of Numerical Control. Editorial Director Bill Schleicher gets down to earth in treating this subject and explains the workings of tapes, punched cards, digital, analog, servo-mechanisms with feedback and all the other important factors involved in numerical control. ..... **Page 111**

Advanced Mechanization in the Large Plant. At the Chevrolet Passenger Transmission plant in Toledo, the pinion gear line uses 62 machine tools, 5 parts washers, and 4 spiral storage units. Chutes, conveyors, parts dividers, distribution conveyors and elevators unify the installation. This integrated-interlocked production line has been successfully developed by Chevrolet. ..... **Page 130**

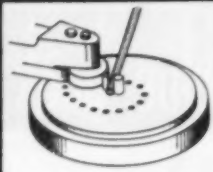
Producing Transmission Housings at Chevrolet. An account of what's involved on the production line with the 41-station transfer machine. The line is divided into 6 sections. A 5-station rotary table indexing machine is required to ready the part for the line. ..... **Page 148**

Advanced Mechanization in the Medium-Sized Plant. The new addition to Reliance Electric & Manufacturing Company's plant at Ashtabula, Ohio, is designed to build parts for stock, not any specific order. Some enlightening information on materials handling and inspection is presented. **Page 162**

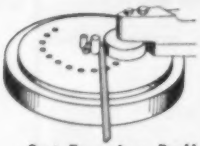
Advanced Mechanization in the Small Plant. The small plant operator can make mechanization pay off, too, and the story of W. L. Garberding and his 23-employee, 14,000 square foot plant proves it. Garberding's approach is strictly functional. He has designed his plant to be very flexible as he turns out all sizes of reamers and counterbores. ..... **Page 170**

HOW TO BEND bars and tubing

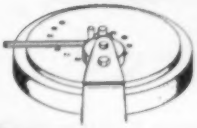
Insert bar stock between Locking Pin and Radius Pin of desired size.



1 OFF CENTER EYES



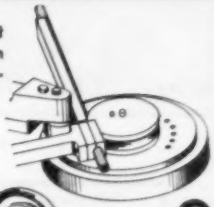
2 Set Forming Roller against material and advance Operating Arm.



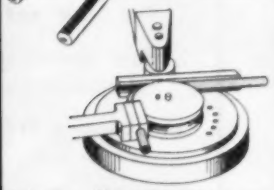
Complete operation with one steady movement.

3

Clamp tube. Insert Follow Block between material and Forming Roller.

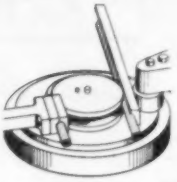


TUBING 1



Advance Operating Arm until it strikes Angle Stop. **2**

Remove Follow Block, release clamp and remove tube.



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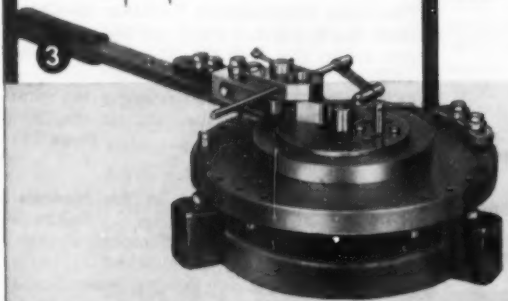

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Why a special report on advanced mechanization?

There has been considerable discussion the past few years about automation. One thing that stands out in our minds is how so many speakers on the subject and nearly every article written about it starts off with a definition of the term. This carries a hint that there might be some confusion over just what automation encompasses.

Automation is no revolutionary concept; it's not new. This is why we refer to it in this issue's special report as advanced mechanization.

What we are aiming to do in this special report is to discuss the principles underlying the correct approach to advanced mechanization and to show how plants of various sizes are applying them successfully. Various degrees of flexibility are required by the large, medium and small plants. Whereas the large plant usually faces a major tooling job once a year, medium sized plants work with smaller quantities for shorter periods of time and in the small plant a tooling set-up may be made for only one day's run or less.

The intelligent application of advanced mechanization is to start at the beginning with the receipt of raw materials at the receiving dock and follow the flow of production through the plant. Every operation must be studied. The secret is to study the plant as one coordinated unit and take it for granted that some functions might be consolidated to take in more than one operation.

Especially in the small plant, concentration should be on functions rather than mechanical operations. When you get involved in the details of eliminating a single motion here, increasing the speed there, or jumping the feed, what happens? You end up with a Rube Goldberg storehouse of individual, often unnecessary gadgets. Synchronizing and cycling these gadgets may pose a bigger problem than the operation justifies.

Never forget this as a plus factor in advanced mechanization at this particular point of the current industrial revolution: Making work easier and more pleasant for employees is as important as getting a machine to turn out parts faster.

—Paul A. Meline
Managing Editor

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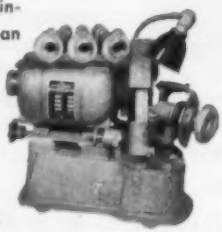

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Meetings, Conventions and Exhibitions

July 29-Aug. 2—National Machine Tool Builders Association annual sales conference, Cornell University, Ithaca, N.Y.

Aug. 28-30—American Institute of Electrical Engineers Pacific general meeting, Chinook Hotel, Yakima, Wash.

Sept. 24-25—Sixth Annual Industrial Electronics Symposium, sponsored by Institute of Radio Engineers Professional Group on Industrial Electronics. The American Institute of Electrical Engineers and Chicago sections of IRE and AIEE, Morrison Hotel, Chicago, Ill.

Oct. 7-11—American Institute of Electrical Engineers Fall General Meeting, Chicago, Ill.

Oct. 21-25—45th National Safety Congress and Exposition. Sessions held at Conrad Hilton, Congress, LaSalle, Morrison and Hamilton Hotels, Chicago, Ill. Headquarters: National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

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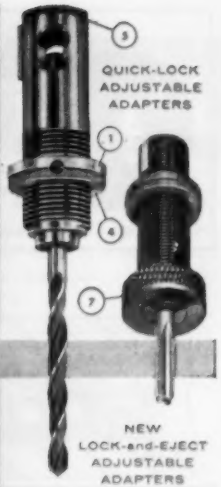
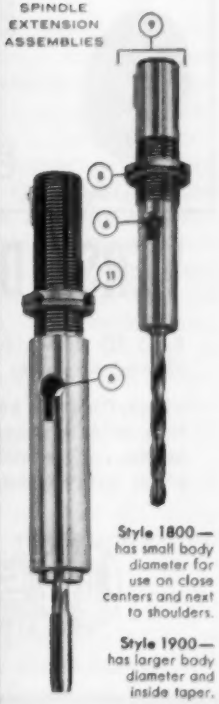
		2. Locking shoe assures even distribution of pressure on all mating threads.
	Cutting tools run true	3. Bore and shank are concentric within .002 in. gaged 6 in. from adapter.
INCREASED PRODUCTION	Faster adjustment	4. Quick-lock nut locks any place on thread by only ¼ turn of set screw.
	Faster tool changes	5. Pilot nose eliminates "binding."
		6. Keyhole-type drift slot simplifies tool ejection.
		7. New Lock-and-Eject type eliminates use of conventional drift.
LOWER TOOL COSTS	Full use of adjustable range of adapter	8. Quick-lock nut is thinner than nuts used on most adapters.
		9. Small diameter permits use on close centers.
	Reduced tool breakage	10. Keyhole-type drift slot eliminates need for hammering with conventional drift.
	Adapter lasts longer	11. Friction-type nut prevents thread damage. Set screw does not contact threads.
		12. "Stressproof" steel induction hardened to give best combination of wear resistance and toughness.
	Solve pull-out problems	13. New Lock-and-Eject type increase holding power.





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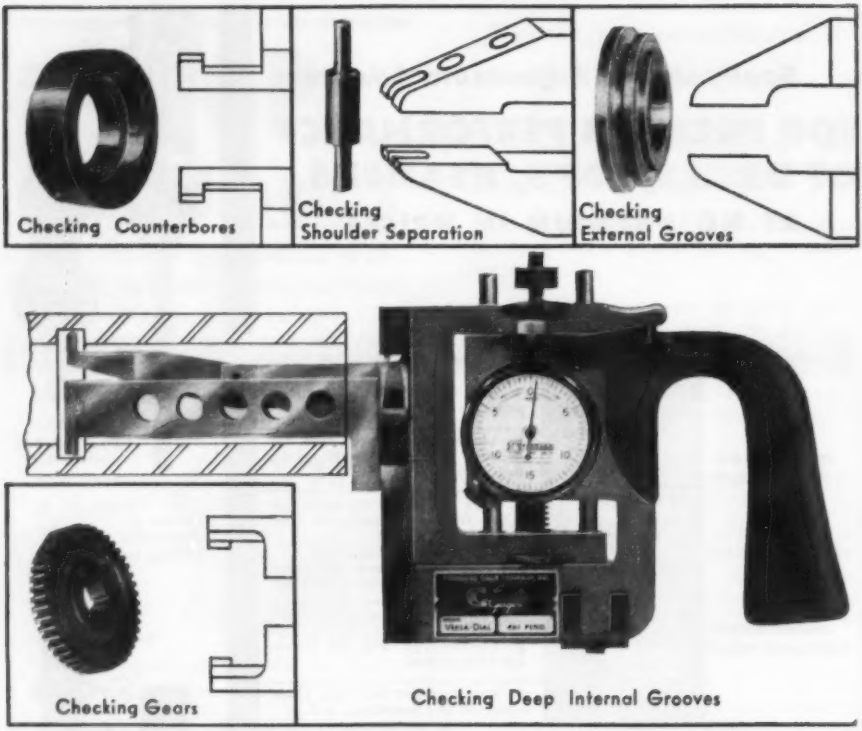

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A few issues of MACHINE and TOOL BLUE BOOK, which have been brought to my attention, have proved both interesting and useful in the planning of my shop, Cotter Machinery Products, which I hope to open in the near future.

Needless to say, your "Products Index" is of immediate interest to me, while your "Shop Hints," "Field Reports" and informative articles promise to be indispensable.

Michael A. Cotter
3462 Sheridan,
Detroit 14, Michigan

Magnesium Machining at Volkswagenwerk

I have just read with a great deal of interest your article in the May 1957 issue concerning Volkswagenwerk in Germany. I think the pictorial method of presentation, with discussion accompanying the pictures, is very effective and I only wish there were more of it.

In particular, being especially interested in magnesium, we would like to have seen something discussed of the magnesium operations. Steel being of much greater universal interest, of course, commands the headlines. I'm wondering, however, whether you have any plans in a subsequent article to present the magnesium machining operations, or, if not, whether you have pictures and data which cover these operations which might be available to us.

Two years ago I made a hurried trip through the Volkswagen plant and I know that because their engine and transmission housings are in magnesium, they had developed a very fine technology in the machine shop practice of this metal. In fact, they have by far the largest magnesium machining operation in the world. Because they are so unique in their utilization of magnesium, I think that an article on this subject would have very good reception. The fact is that some of the principal Detroit automobile companies are very seriously looking at this type of operation for the future. While Volkswagen's chief engineer, Dr. Boehner, did give a talk on their magnesium engine in this country a couple of years ago, he did not give the kind of detail on their machining operations which your magazine has presented in the May issue.

J. Donald Hanawalt
Vice President and Manager
Magnesium Department
The Dow Chemical Company
Midland, Mich.

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Letters

continued

Welded Base for Chucker

. . . . The story in the May issue describing the Cone Automatic Machine Company's welded base looks to me like an excellent presentation of this material. I hope many of your readers will take its message to heart.

We would like to reprint this for distribution to our libraries. May we do so?

I was very much disappointed, however, not to see some credit given to the Lincoln Foundation and to the fact that the paper originally received an award in one of our design competitions.

CHARLES S. HERBRUCK
The JAMES F. LINCOLN
ARC WELDING FOUNDATION
Cleveland, Ohio

Permission to reprint was granted. The editors are sorry for the oversight in giving credit to the Lincoln Arc Welding Foundation who sponsored the competition, and awarded a top prize to H. H. Ranney and John S. Miller of Cone Automatic Machine Co., Inc., for their excellent entry "Welded Base for Chucker Provides Greater Rigidity, Less Weight and Improved Appearance." This article appeared on page 130 of the May Machine & Tool Blue Book.

SPECIAL REPORT
Controls and Advanced Mechanization
See page 5 for contents

It's New! **It's what you've been waiting for!**

The ADAMS UPRIGHT DRILLING MACHINE

- Has that extra room under the spindle, the extra swing, and the bigger table that lets you do the job that other machines of the same size can't handle without a complete change in set-up. Note and compare; Spindle travel, 10″; Head travel, 10″; Table travel, 18″.

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"We know that much of the Defense Department equipment that is being used in current production is either worn, or obsolete, or both. Replacement with modern and efficient tools would reduce current production costs. It would also improve our ability to increase production in an emergency, if that became necessary.

"We directed the military departments to make plans for a definite replacement program, and funds for that purpose have been requested in the fiscal year 1958 budget, which has been sent to Congress. The rate of replacement will undoubtedly be less than considerations of current production costs alone would dictate. However, if the funds are appropriated by Congress, we will be able to make progress in the right direction. We are now setting up procedures for selecting old equipment for replacement, so as to get the greatest return in reduced production costs."

Perkins McGuire
Assistant Secretary of Defense

Foreign Aid Budget To Be Cut?

Senate Appropriation Committee leaders predict a budget cut of at least $1.2 billion in foreign aid. Probably the major conflict between Congress and the President will develop on how and where funds should be spent. The Administration wants flexibility. Many legislators favor selectivity. They want no further aid sent to countries behind the iron curtain.

Instead, they would grant assistance to nations which have proved their opposition to communism: Saudi Arabia, Spain, South Korea, Greece, Formosa, Turkey, Iraq, Iran, Pakistan, Thailand, Viet Nam, the Philippines. "Selective" legislators also want to know the specific amount to be granted to each country.

Government Spending Expected to Rise

A group of private economists have predicted that government spending will continue to rise over the next few years, in spite of the economy drive in Congress. Senator Byrd (D., Va.) disagrees. He believes that the economy campaign will force the President to reduce the budget he will submit next January, even if Government spending remains high in fiscal 1958.

continued

Small Business Loans

The Small Business Administration has approved 12,272 business and disaster loans totaling $357,744,000 from the start of the lending program, Sept. 29, 1953 through April 30, 1957.

Business loan approvals totaled 6443 for $294,618,000 and disaster loan approvals totaled 5829 for $63,126,000. Sixty-nine percent of the business loans—4489 loan approvals for $212,171,000—were made in participation with private banks throughout the country, in line with the agency's policy to help small firms develop credit with private banks.

During April 784 business loans were approved for $38,760,000. April disaster loan approvals totaled 326 for $2,407,000.

ODM Director Tells NMTBA of Mobilization Program

In an address before the 55th spring meeting of the National Machine Tool Builders Association at Washington recently, Director of the Office of Defense Mobilization Gordon Gray spoke of mobilization readiness action programs: continuity of government; regional mobilization coordination; damage assessment; determination of survival requirements; testing of preparations through Operation Alert.

"In the field of machine tools the Office of Defense Mobilization has sponsored and is engaged in a number of important programs. On all of these the advice and counsel of your industry has been sought and given most careful considera-

" . . . I believe that our present prosperity is only a prelude to a new age of boundless opportunities now being ushered in.

"Secretary of Labor Mitchell says that if our economy continues to expand at recent rates, we will need to produce goods and services worth $560 billion in 1965. A prominent professor of economics estimates it even higher, at $570 billion.

"A gross national product of $560 billion in 1965 will require the employment of 74 million people—9 million more jobs than exist today. Think what a boost to purchasing power the creation of these millions of jobs will provide, what it means to all businesses, large and small. And on top of this our population is skyrocketing and may well hit 190 million by 1965—a clear indication to all businessmen that the years ahead will open up enormous opportunities in all fields."

Wendell B. Barnes, Administrator
Small Business Administration

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You'll find, in addition, that Lamina Guide Pins and Bushings prolong die life, improve quality control, reduce downtime and cut costs . . . because the special tool steel of Lamina Guide Pins is uniformly heat treated, spray quenched and precision ground to resist wear, bending, "mushrooming" . . . and because Lamina Bronze-Plated Wring-Fit Bushings are strain relieved and pre-finished on the I.D. to assure distortion-free smooth operation, proper lubrication, positive alignment. What's more, there's a Lamina Guide Pin and Bushing for every die set need.

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***NUT TYPE**—For wide range of general purpose requirements. Available in 5 sizes, 1" to 2" pin diameters.*

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continued

tion. Included among these are such important programs as the M-Day Pool Order program, the elephant tool program, the program for control of non-defense leasing, the central inventorying of idle equipment, the program for review of surplus equipment prior to sale, review of government tool purchases from foreign sources and the program for the development of uniform leasing practices. Of considerable current interest is the leasing practices program.

". . . I should like to point out that in the formulation of this leasing policy the consensus principle —the principle of participation by groups which are to be affected— has been operative throughout the entire process. I should like, therefore, to ask your cooperation on such policy directives as are bound to result from the work of this group. *I ask that any expressed dissatisfactions that you may have with this program, or the other programs which we are striving to complete, contain suggestions on how we may improve and perfect what has been accomplished rather than abandon it. We all know that true progress is of an evolutionary rather than a revolutionary character. At many of our difficult tasks we cannot make progress by tearing down what we have and starting over again. Instead, we need to preserve what is good in what we have developed and strive with your help to improve and refine until we arrive at a reasonably adequate and practicable conclusion."*

Expanded Airways Plan Submitted

An expanded and expedited five-year program developed by the Civil Aeronautics Administration for modernizing the nation's air traffic control system to meet jet age needs has been submitted to Congress.

Estimated cost of equipment required from now to 1962 is $810,045,000. The program is detailed in the publication, "Federal Airway Plan, Fiscal Years 1957-1962." It is a revision of the plan announced a year ago, which called for equipment expenditures of $246,000,000 in the fiscal years 1957-1961.

Secretary of Commerce, Sinclair

"Profits are the economy's insurance policy against mal-adjustment and failure. They are no idle plaything but a vital reservoir to be tapped with great care, for the sake of both a business enterprise and the country it helps to sustain."
Franklin, Ind., **Republican**

THREAD ROLLING

LANHYROL

WORKPIECE: Jack Screw

MATERIAL: C1018 Steel
THREAD SPECIFICATIONS:
1"-5 pitch 29° Acme
TOLERANCE: Class 4C
METHOD: Thrufeed Rolling
PRODUCTION: 30" per minute (rolled in 36" lengths—can be rolled in 12' lengths)

WORKPIECE: Barrel—MG Gun Perforator

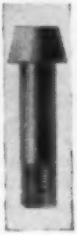
MATERIAL: .60 Carb. Silicon Tool Stl.
THREAD SPECIFICATIONS: 1-7/8"-6 pitch Stub Acme—1" thread length
TOLERANCE: Class 3G
METHOD: Infeed Rolling (hand-operated workholding fixture)
PRODUCTION: 15 pieces per minute

WORKPIECE: Transfer Drive Worm

MATERIAL: Stainless Steel
THREAD SPECIFICATIONS: 1/4"-26 diametral pitch, left-hand, single—3/4" thread length
TOLERANCE: .1825—.1805 P.D.
METHOD: Infeed Rolling (manual loading)

WORKPIECE: Aircraft Bolt

MATERIAL: 4340 Steel of 36-40 Rockwell C
THREAD SPECIFICATIONS: 1"-14 pitch NF—1-5/16" thread length
TOLERANCE: Class 3A (Military Spec. MIL-B-7838-A)
METHOD: Infeed Rolling (manual loading)
PRODUCTION: 10 pieces per minute



Field installations of the new LANHYROL Thread Rolling Machine are producing outstanding results. Production data from representative jobs, as shown, indicate the unequalled output, flexibility, and range coverage of this revolutionary new machine, not available anywhere else in the Western Hemisphere.

The LANHYROL Thread Rolling Machine produces strong, accurate threads of excellent finish by the chipless, cold-forming process using four different Rolling Methods—Thrufeed, Infeed, Continuous, and Reciprocal. It will thread all diameters from 3/16" to 3", producing left- and right-hand threads of all types (except square), including UNC, UNF, Acme, worm, and many special forms.

Additional information on request—please send specifications and ask for Bulletin E-60.

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA

469

continued

Weeks said that telescoping of the program to effect increased readiness for jet transport service, claimed to be only two years off, accounts in large part of the increased cost.

• • •

Waste in Armed Services

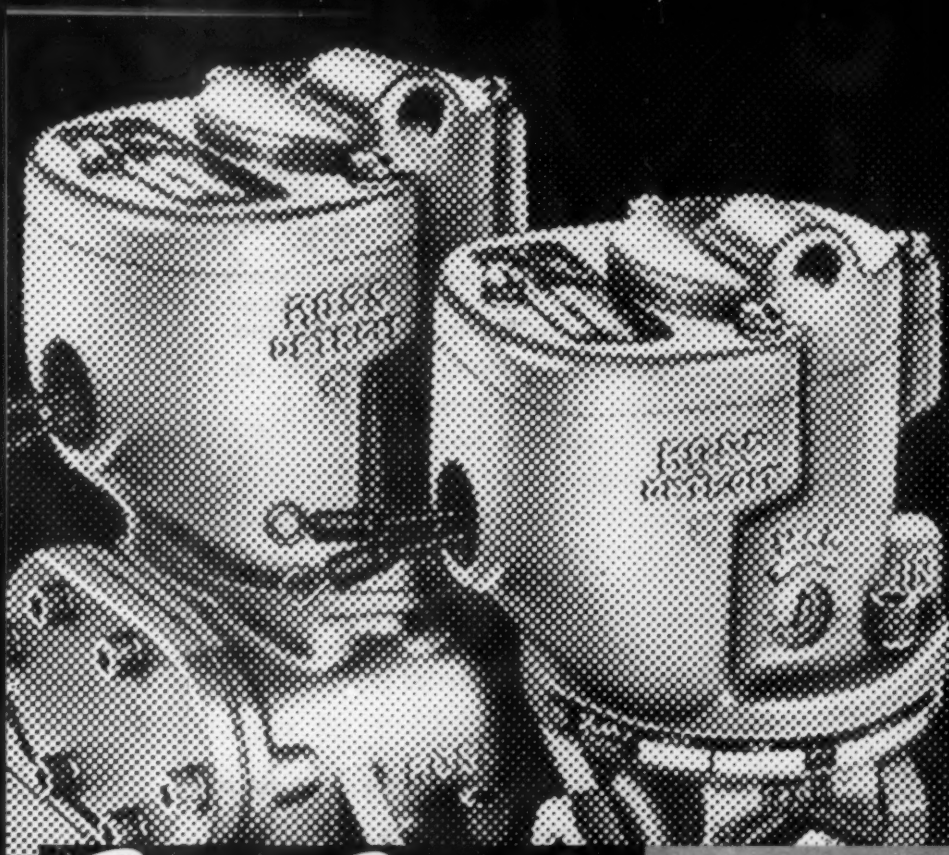
Both civilians and servicemen are writing Congress to question specific examples of waste and extravagance in armed services. For instance, they are asking why so-called "training flights" outside the U.S. bring back liquor to officers, avoiding the usual taxes; why faulty designing of many tanks, airplanes, etc., was ignored by the military when pointed out by civilian engineers, and must be replaced now at tremendous expense; why the Navy keeps luxurious planes at airbases for the personal use of Admirals and important government personnel.

According to a reliable source, military waste probably runs into billions. Technicalities and rules of secrecy conceal much of it, but enough is apparent to the average citizen to cause him to rise in protest.

Generals and Admirals spend about half of each tax dollar. Each man wants the best for his particular branch of the service and is liable to lose his sense of balance in the struggle. Is the defense budget getting dangerously out of control?

"Taxes are now taking your earnings for almost twenty minutes out of each hour of work, if you are a typical United States citizen . . . Taxes are the economic burden we impose upon one another by means of force through government, in attempting to deal with those human differences which we refuse to tolerate. They are the expenses incurred when some persons try to control or change the conduct of other persons by means of the government as a monopoly agent of force. The problem is to learn how to deal with these human differences so that they fructify rather than sterilize attainment . . . In a completely governed society everything that is not compulsory is forbidden . . . The proportion of our productive effort which has been absorbed in the attempt to control the actions of one another has grown fabulously and dangerously. Has the average person in the United States become so much more corrupt and evil over the years that we must spend one-third of our time in controlling each other? Does the present generation require six times as much governing as their grandparents and great-grandparents did?"

Dr. F. A. Harper
The Freeman, April '57



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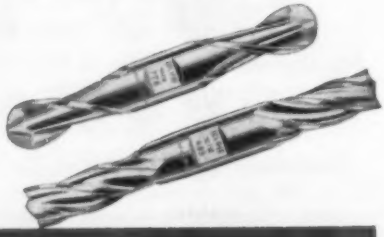

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What's ahead for automation machinery?

"More flexibility through the building block concept."

—Ralph E. Cross

Executive Vice President
The Cross Company

A leading automation machinery manufacturer discusses training procedures for maintenance people, where automation equipment is justified, mechanization of inspection, capital recovery, automation in an old plant, and how his company trains its engineers.

Q. Mr. Cross, what have you to say about statements circulating that automation is becoming so expensive that it is getting to be impractical?

A. Of course, there is always pressure exerted to reduce the price of equipment and we're conscious of that. I don't think automation is becoming more expensive, really. It's just that things are being put together in such a way that it comes in bigger packages; but there are fewer packages, and when you add up the total I don't think it's any more expensive than the multitude of little packages you used to have.

continued

Industry is certainly becoming more conscious of the cost of equipment, the cost of changing it for model changes or other changes for competitive reasons. We are conscious of it too and are constantly working to make automation machinery more flexible and less expensive. We believe that the building block idea is the best answer. This idea is still in its infancy, and we believe that it will grow substantially and make changeovers easier and less costly.

About Ralph E. Cross

Ralph E. Cross is a native Detroiter. He was educated in Detroit schools, and attended the Massachusetts Institute of Technology from 1928 to 1932.

Since joining The Cross Company in 1932, he has served in the manufacturing, service, engineering and sales departments. He is now executive vice president, in charge of engineering, service, sales and advertising.

Mr. Cross is widely known in the machine tool industry as the originator of a number of important developments in automation. In 1956 he received the American Society of Tool Engineers Engineering Citation for his work in the development and application of automation principles to machine tools and manufacturing processes.

During the spring of 1954, he was a special technical advisor to the U. S. team that went to Europe on East-West Trade Negotiations.

Q. More industries outside of the automotive field are becoming interested in automation. Are they trying to go Rube Goldberg one better or are they overly cautious?

A. I think they show a remarkable degree of restraint; that is, they have the desire to analyze the thing properly and to get the best equipment to do their work. I think one of the mistakes some companies make when they first get into automation is not to procure enough equipment to do their job properly. Of course, it's our job to guard against that and make sure they obtain an installation suitable for their means. Sometimes people want to go too far. But when we present the various alternates that are available to them to do a job, it usually becomes quite obvious that the frills aren't economical.

Q. After the machines are installed, what is your part in training the technicians that are going to be hired to operate and maintain them?

A. Our service department gives training to maintenance people. Recently we started a program of developing course outlines for training people to utilize our equipment. These course outlines are being developed for hydraulic, electrical, machine and tool maintenance. Our service people give

the instructions in the beginning. Our customers continue the instruction as they acquire and develop new personnel.

Q. In some manufacturing plants, where the production runs aren't so long, there is the feeling that automation is not feasible. Where is the dividing line on the amount of work pieces produced that justifies automated equipment?

A. It isn't necessarily the volume that's important; it's the volume and the weight of the product. As the weight goes up, the volume can go down, and as the weight goes down, the volume must go up to justify the application of automation. For example, in making common pins you must have tremendous volume to sustain automatic production. As you move away from that you come to the point where you can make automobile parts at a 100 to 150-an-hour rate in order to sustain automation. As for larger parts, we've made machines for heavy pieces, like a railroad axle that may weigh 1000 pounds each. Here you can get down to the point where automation will justify itself for maybe 15 or 20 pieces an hour. One exception to this rule is in the aircraft industry where they have thousands of operations on one part. Unless there is some automaticity, it's virtually impossible to perform all operations without making a mistake somewhere along the line. Of course, that means that with conventional tool methods and low production you can't make a perfect part or a part that's within tolerances. Under these conditions we feel that automation or automatic equipment is justified.

Q. In the aircraft industry much of their production is for the government. The government is great on design changes. When you get going on a setup and there's a design change, it plays havoc with your engineers, doesn't it?

A. It does, but we've been designing for more flexible equipment that could be changed more readily and easily. We try to anticipate what the aircraft engine people are trying to do and I think we've attained a good deal of success in that direction, with our building block concept and our ability to make machines that can be changed over with a minimum amount of effort.

Q. Of course, if you know some design change is not going to be made for a number of years, like in an engine block, there's not such a need for flexibility and you could build the machine at lower cost, couldn't you?

A. Well, that's probably true, but we never know that. As for the machine that we have on the floor here for engine blocks, we could actually make any engine block in the industry on that machine with small modifications. The machine was designed that way. I'm sure our customers cannot say for sure

continued

that they're going to make the same product for a given number of years. I know that's not true in the automobile industry at least, and their ability to plan ahead in buying machines of this type depends on our ability to put flexibility into them so that if they do have a change, it can be made with a minimum amount of effort.

Q. They don't know if in the future there are going to be fewer or more model changes, do they?

A. From what we've been able to learn, they expect more, because technology is changing rapidly. For example, automobile companies have to change more often to accommodate the wishes of their customers. Of course, that is why they're so interested and so anxious to have machinery that can be changed quickly at minimum expense.

Q. Will the automotive people ever get together on standardization?

A. They do have some standardization now in the electrical and hydraulic areas. I don't think that they would want to freeze manufacturing methods at this time, because I don't believe we've reached a point where it would be desirable to do so from their point of view. No doubt, when the time comes they will push for it because it will be to their benefit to do it. I don't think we've reached that point yet.

Q. What is the trend of inspection procedures with respect to automation machinery?

A. There's a tendency to mechanize inspection procedures. However, in the production plants, inspection cannot be turned over to production personnel yet, and I don't know if it will ever be that way in the future. Quality control is not a function of the production manager's job; it's his business but it has to be supervised by other people. As long as production people can turn the built-in quality control devices on and off on the machines that we make, then there will always have to be a police force available to see that the quality is maintained. There are some plants that do not want quality control built into their machines, for the simple reason that it gives production too much authority over quality. So efforts to mechanize inspection have been retarded somewhat by that set of circumstances which exists in some plants, but I think the time will come when inspection will be mechanized to a greater degree.

Some of the measuring devices are much too sensitive to be incorporated into a production machine, and, therefore, they don't function

properly in line production along with other mechanisms that are of a more rugged nature. Some of the sensitive measuring operations don't go with some of the more rugged metal removing operations, for example, and they have to be divorced. Some require temperature control and such things as that, and we have just not found a way yet of putting them together. But I think as time goes on we will find ways and that is part of our future.

Q. It appears that most new transfer line equipment has been installed in new plants. What about the older plant? Is there no chance to make the flow of materials just right?

A. It's true that a lot of automation machinery does go into new plants, but we can fit it into old plants, too. Of course, if you're going to modernize a facility, I think that you should do the whole job; by that I mean, analyze the design of the product, the machinery, the building, the method of selling, and all the rest. There's no sense in modernizing half way. If you're going to do the job, you might as well get the benefits of doing a complete job because if you modernize your machinery and put it in a plant that's half obsolete, or try to sell your product with a half obsolete sales program, or if you try to tool up a product that is half obsolete by design, you will find that you are doing the job more often than you should. • • •

HEAVY MACHINING LINE at the new Cross Company plant. Material flows through machines in foreground, then through inspection, and is assembled and shipped at the rear.

continued

We set up our own training course

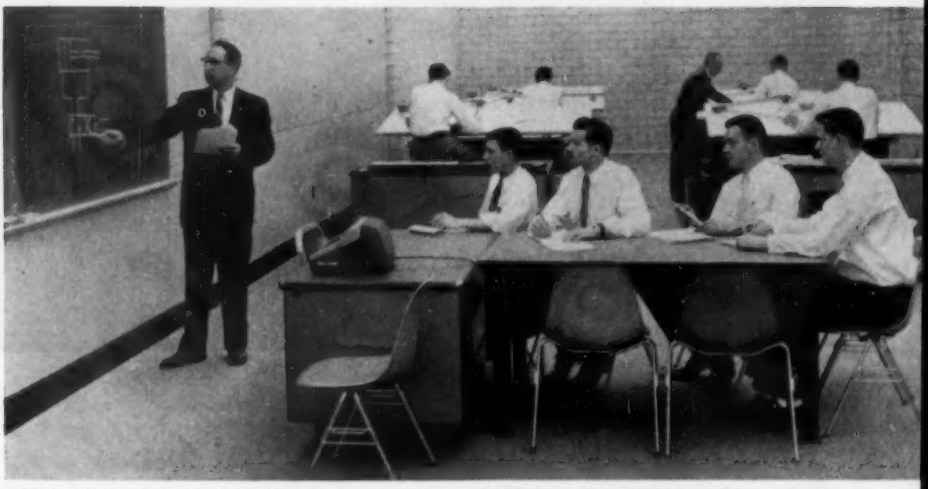
We developed the Cross Engineering School to provide a continuous supply of engineers and draftsmen for our expanding automation machinery business. The idea came from some of our past experiences.

It was when we felt the pinch for engineers that we began to look for a way of training men for our type of work.

We decided to set up a school separate from our regular Engineering Department so we could put the emphasis on learning instead of on getting the job done. To minimize the cost of the program, we decided we would provide a short six months course. This would also have the advantage of permitting us to recruit students from every graduating class. Our objectives are to teach the student *how* to design automation machinery and *how* to advance and grow in our Engineering Department. We feel that perfection will be gained by the student through experience after he understands how the job is done. The course starts with a short indoctrination period to inform the student about the machine tool industry and The Cross Company, then each student goes through all of the motions of designing a special machine. In effect, the student is a project engineer, a machine designer, a detailer and a checker, all in one. The projects assigned to the student are developed in our Proposal Department in much the same way as we develop them for a customer. Each project is specially created to bring out certain elements in machine design that we want the students to learn, in addition to the design procedures. When the project is assigned to the student, he receives a fictitious sales order, a proposal, a proposal drawing and an estimate of the machine. This is the same information that is given to a regular project engineer when he is given an assignment in the Engineering Department. The student then designs the machine from beginning to end to the specifications contained in the sales order and the proposal.

Throughout the entire course, part of each day is devoted to classroom instruction in mathematics, mechanisms, hydraulic systems, electrical systems, the use of drafting machines, calculators, commercial catalogs and Cross Engineering Standards.

for a continuous supply of engineers



ENGINEERING CLASS at Cross Company has a problem explained by Joseph Cohen, training instructor. This firm also has training programs for apprentice machinists, squad leaders and foremen.

Applicants for the course must have a technical high school education, plus one year of practical experience in drafting or shop work. To eliminate the square pegs in the round holes, we use aptitude, intelligence and personality tests, plus extensive interviews.

When the student is finished with the course, he is placed in our Engineering Department in a position commensurate with his capabilities, and he is encouraged to continue his engineering education at night so that he will eventually obtain an engineering degree. By the time he is through with the training program, he understands exactly why we do things the way we do, he has a good attitude towards his work and he is confident in his ability. Because we have a sizable investment in each student, we are motivated to make him grow and become more valuable, and that is exactly what we were looking for when we conceived the Engineering School.

—Ralph E. Cross

QUALITY CONTROL REPORT

These sparks reveal vital facts about quality control of steel

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The 'How' and 'Why' of Numerical Control

Tapes, punched cards, digital, analog, servo-mechanisms with feedback—let's get down to earth and discuss this terminology in everyday language.

By **William F. Schleicher**
Vice Pres. & Editorial Director
Hitchcock Publishing Co.

• Everybody talks about Automation! Computers more accurate than the human brain, push-button factories, numerical control systems, tapes and punched cards, digital and analog control units, servo-mechanisms with feedback, what an array of terminology for most of us who want to do no more than remove metal a little faster and a little cheaper.

While many people know exactly what all this means and can talk learnedly on it for hours on end, it is questionable if many of us can stay in the race against sleep long enough to get even a hint of what it's all about. As a matter of fact, there are so many types of systems and controls and methods and ways and means of doing things without human aid that the experts aren't sure among themselves which is best. There are no standards. The general has mounted his horse and gone off in all directions at once screaming orders at the top of his voice.

A good philosophy on deep matters such as these has always been: eat three square meals a day, get eight hours of sleep and don't worry! However, this cannot always be done; there are times when we have to forget the eight hours' sleep and worry a little. It appears

continued

that these weighty matters are with us and we must, perforce, take a quick look at them, if for no other reason than that we won't be too suddenly surprised when numerically controlled machine tools are the only ones on the market, if it ever comes to that.

On the following pages we have tried, in a small way, to analyze one numerically-controlled system and explain such things as digital, analog, servo-mechanism, etc. as they relate to machine tool operations and present the thinking of machine tool builders on the direction they're taking.

The first step to understanding is to realize that automation is so much poppycock. We think it is something new, instead it's been with us for a hundred years or more. We should call the methods now embraced by "automation" by its real name: Advanced Mechanization.

This playing with words has caused confusion to be rampant. Many techniques are labeled automation when they really are no more than standard, good machining practice. What's the difference between a well tooled 8-spindle bar machine and a transfer-type machine? It's a difference in degree, but not in kind. Both machines perform multiple operations on one part, loading and unloading is automatic, movement from one machining station to the next is also accomplished without human help. Basically, there's no difference between the two operations; however, in the transfer type machine several new quirks were added, and these additions lead us to believe that a new era of metalworking, with a new name, has dawned.

In surveying the development of machining practice we are struck by its evolutionary nature. First came the hand shop with its crude equipment and negligible production. As machine tools and skills developed shops grew larger to meet demand for goods; some began to specialize and from simple hand shops grew into large scale

Numerical Control

continued

turers had to organize their production so that goods could be produced efficiently and in volume; consequently, there developed the progressive line in which machines are arranged according to the work which must be done on the product. From here the next logical step was to conveyorize the parts and carry them from machine to machine without human aid. Transfer machines were the result of the necessity for producing more goods at a lower cost.

The accessory equipment needed to bring about the efficient operation of these different production lines spurred developments in the electrical, electronic, fluid power, inspection, material handling and other fields.

If one moves a part from one machining station to the next without human help there must be equipment to substitute for the usual human muscle: Hydraulics, compressed air, or electrically powered conveyors were used. Inspection during the process, or in-process inspection was developed. The need now arose for equipment which would not only inspect the part but also tell the machine that the part was either good or bad; if bad then it would tell the machine to stop. Then there had to be timing mechanisms which would stop the part at a particular point in the machine, tell the machine station when to remove metal, when to stop, when to remove its tools from the part, and when to move the part to the next station. The timing must be so exact that the parts at the end of the machine, those in the middle, and those just starting into the machine all stop at the same time, are machined simultaneously and move to the next station at the same time. Interlocking timing and control devices were developed and housed in big cabinets, complex enough with all its wires, like spaghetti, to frighten you and me into complete demoralization.

Then somebody became greatly dissatisfied with this entire development and he decided that much time and manpower could be saved if some human agency didn't have to set up the tools but simply tell the machine to do thus and so.

Before you knew it we had tape controlled machines and an entire new world of controls, mechanisms, tubes, relays, switches, etc., to say nothing of terminology.

But here is the wonderful part of all this new development work. In the historical development of production techniques, the job shop, and even the smaller production shop remained relatively untouched, except that they did benefit from allied developments, new tools, materials, inspection equipment, etc. But they could not get into the in-line production processes, not into the conveyorized processes and could not utilize special machines as successfully as the

system, being always mindful of variations which exist between the

carried into position and carried to an end point under controlled

continued

large volume production shops. But as work progresses on the completely automatic machine tool, which had intended to be an extension and a further development of the conveyorized-line method of manufacturing, it develops that the automatic machine tool—which we have come to know as the numerically-controlled-machine—is as suitable for the job shop and the medium-sized shop, as for the big shop. As a matter of fact, some machine tool builders are frank to admit that their goal is to develop numerically-controlled machines for the small and medium-sized shops.

So far we have treated our subject casually and generally. We have left ourselves open to the danger which is inherent in generalizations; however, we must become, when discussing the numerically-controlled machine, a bit more specific, not too much, but enough so that understanding results.

Much confusion can be removed from the automatic machine tool when we remember that it is basically a standard machine tool so equipped that it performs work by automatically following a set of instructions.

We're finding ways and means of substituting the operator's turning of handwheels and making adjustments and change overs. This reduces the problem to one major point: Feeding information to the machine. And this is nothing new; we've had the storage of information for machine tools with us for a long time. As a matter of fact, Thomas Blanchard in 1818 developed the copying lathe for turning gunstocks. This was comprised chiefly of a cam follower and was the forerunner of copying attachments. The Keller machine, developed by Shaw in Keller's shop in 1921, uses an inexpensive model as the source of information and a tracer device which translates the model's contours to the cutting tool.

In the last analysis a discussion of the automatic machine tool centers around the methods and means of getting information to the cutting tool and some means of telling the cutting tool exactly what it is supposed to do.

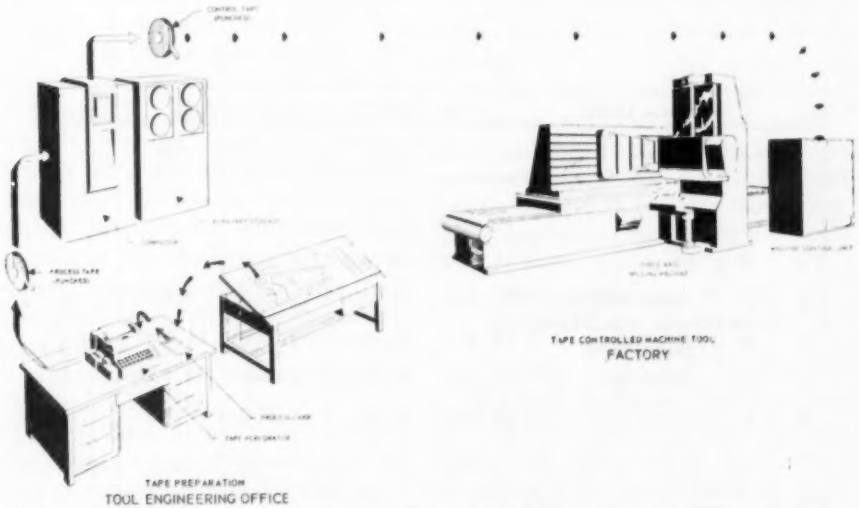
The Numerically Controlled Machine Tool

There are at present over 15 different kinds of control systems available to the end user. Imagine the various combinations in which these can be used, add to this the multitude of components, and you can well imagine that a description of the various control units is an endless task. We would all be asleep before the description was even started. In our present effort we will limit ourselves to a basic discussion of one numerical control

system, being always mindful of variations which exist between the various systems.

The choice of systems is further complicated by the type of work the numerical control equipment is to perform. RETMA (Radio Electronic TV Manufacturers Association) have boiled the type of work down to three areas: The first and simplest is the positioning table area. Here the problem is concerned with a minimum of information. On the positioning table we only read in a dimension for X and Y. We simply move from one point to another in rectilinear line with only the end points critical. The second area is covered by the turret lathe where the tool is carried into position and carried to an end point under controlled rate. During the process of the tool's arriving at the precise end point it may encounter an obstacle which may necessitate retraction of the tool, a change in feed rate, etc. as is found in turret lathe work when working on a step shaft. In general, however, it is still a rectilinear problem. Yet a great deal more information must be supplied to the machine via the tape than is necessary with a positioning table; consequently, the equipment used becomes more complex.

The last area is that encountered in the aircraft industry and which was the original concern of the MIT research program. Here the



1. A numerically controlled contour milling machine. Note that the system is operated through five steps; 1. Blueprint and process card, 2. Punched process tape, 3. Computer, 4. Machine control unit, and 5. Milling machine.

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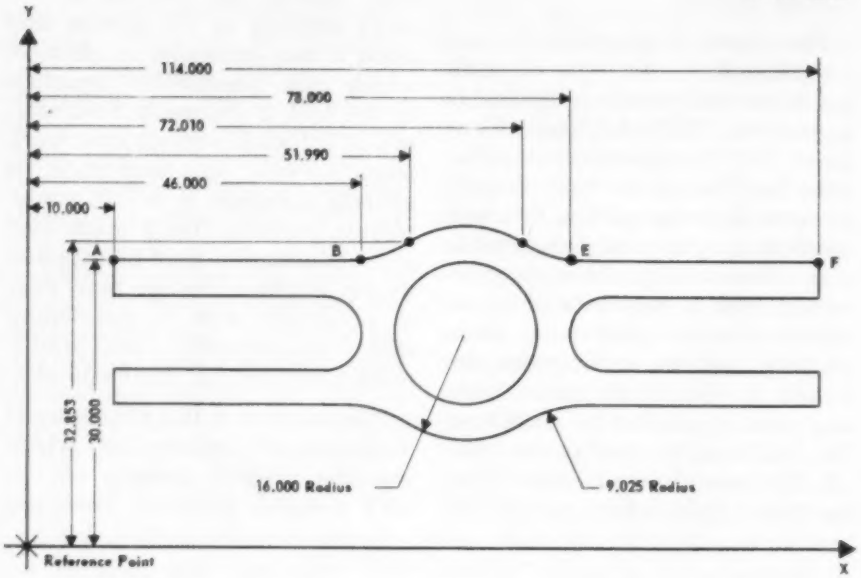


WORK ORDER NO. 10389 DWG. NO 32B447 DATE 5-20-55

Section		Cutter Radius (in.)	Feed Rate (in./min.)	Cutter L(1) R(2)	Tolerance (mils)	End Point Of Section X	Y	Z	Circle Radius (in.)	Cutter L(1) R(2)
Start						10.000	30.000	12.000		
A	B	1.50	40.0	1	.3	46.000	30.000	12.000		
B	C	1.50	25.0	1	.3	51.990	32.853	12.000	9.025	1
C	D	1.50	25.0	1	.3	72.010	32.853	12.000	16.000	2
D	E	1.50	25.0	1	.3	78.000	30.000	12.000	9.025	1
E	F	1.50	40.0	1	.3	114.000	30.000	12.000		

2. A typical blueprint and process card preparatory to making the process tape.

two areas just discussed are combined with the complex matter of generating curved surfaces in three dimensions. This is understandably the most expensive and most ambitious equipment of all. Additional equipment is needed for this type of work. Basically, all three areas are similar.

Uses of Three Types of Numerically Controlled Machines

The curved surface type has been associated with the aircraft industry and many people have come to associate numerically controlled machines with this industry. Those poor fellows are always changing the design. Set ups are torn down, new templates made, and a lot of hard work takes place. When all is said and done they make only a few pieces. The continuous contouring type of machine is splendid here. A change in design? Cover up the punched holes, punch a couple of new ones and away they go. Run a dozen or two dozen pieces and store the tape until the job comes along again. Change, and always on the most complex and intricate forms imaginable, is the order of the day; a numerically controlled machine is a splendid thing here.

As we look at machines used in the aforementioned three areas, we find that they are no different from the machines we've always been accustomed to. Positioning tables, turret lathes and milling machines look and perform as they always have.

In general, these numerically controlled machines are ideally suited for small lot work where changeover is frequent or where the same job comes at irregular interval.

For instance, a manufacturer of pump rods has a continuous replacement problem involving 350 different but quite similar parts. There are about 5 operations on the part. This manufacturer can use numerically controlled machines with efficiency. Whenever a replacement comes in he merely selects the proper tape, puts it on the machine and he's all set. In this particular installation the manufacturer is also hooking up lathes, spline miller, threading machine and grinders, etc., and operates them from a central console board.

These numerically controlled machines will be used for general tool and die work, tooling for mass production, prototypes, small lot production and for the machining of complex machine parts.

The Language of the Numerically Controlled Machine

Because these machines consist of various elements and components all interrelated and interdependent, we must think of them as a system. If we compare them to the human body, controlled and directed by a central nervous sys-

continued

tem, and consisting of arms, hands, heart, head, all connected by nerves, we'll be on the right road to understanding them.

Let us build a numerically controlled contouring milling machine system, like the one in figure 1.

We begin with the blueprint to find out what needs doing, but because our control system is a logical system which proceeds from a beginning to an end without hopping around we must translate the blueprint into a logical form which the system can understand. There must be beginning reference points. These reference points lie outside of the part. All longitudinal feeds are measured from the line X, all cross-feeds from Y and all vertical feeds from Z. Everything is measured from these lines, X, Y or Z. A typical blueprint is shown in figure 2.

These figures on the blueprints are not new figures, they look unusual because we are not used to measuring every dimension from one reference line like X or Y. They are, however, the same numbers as found on the original blueprint. These numbers are now transferred to process cards or process sheets which will serve the same purpose as the original blueprint, see figure 2. You are now working with a digital system. Nothing but numbers. Not numbers arranged very fancily, not numbers which have been given a different value by a method of converting, but the same kind of every-day numbers used in an automatic adding machine. The adding machine is a digital computer. So when someone says, we're using a digital system, it means that he is using just plain numbers like an adding machine.

This may be a good place to stop and look at the difference between digital and analog.

A digital computer works with numbers, an analog computer works with quantities of electrical voltages.

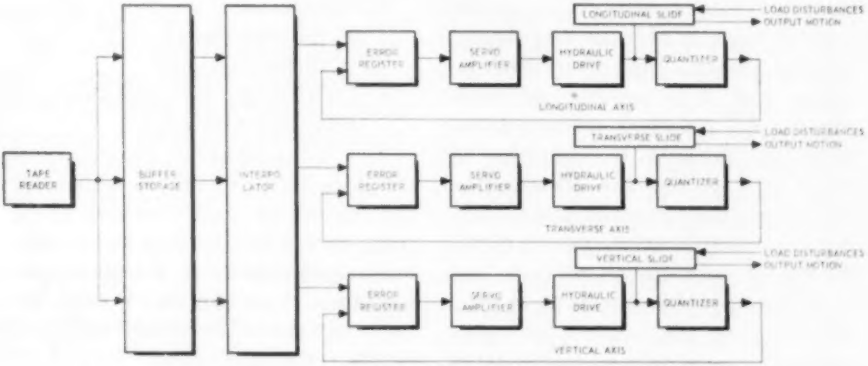
One term commonly used is digital-to-analog. Suppose 40 men were walking in single file. The first five men were six feet apart, the next five men were five feet apart, the next five men were four feet apart, continuing down to the last five men, who would be literally climbing up each other's backs.

Suppose this single file were passing through swinging doors which opened automatically by means of electric eye signals. As the first five men, six feet apart, passed the electric eye the doors would swing open and shut after each man. The next five men, five feet apart, would pass the eye but because they are only five feet apart, the doors won't quite close after one before the next opened them again. When you got to the

men who were two feet apart the doors would open, start to shut, and be jerked open again because the next man would already be breaking the electric beam. With the last of the 40 men the beam would be broken constantly and the door wouldn't shut at all. Now, the spacing of the men in the single file is digital (numerical), but as they pass through the electric eye beam the breaking of the beam would result in a signal (analog)

An ordinary paper tape is inserted in a special, but commercially available, typewriter and all this information is punched into the tape, called process tape.

Everything on the process card is punched into the tape. The process tape is then fed into a computer where everything is quickly calculated to enable the machine tool eventually to perform its work. The computer now punches a new tape, called control or command tape.



3. Functional block diagram of the machine control system.

being passed to a unit which would open the door. So we have a number translated into voltages and we've accomplished digital-to-analog.

To return to the system we're building. We have all the information we need on the process cards, having added information regarding diameter of the cutter to be used, the feed rate, the tolerances which we want the machine to observe.

It is this tape which will be used in guiding the machine tool through its functions. The proper feed rate in relation to the cut and in relation to the cutter radius is all computed here; everything is coordinated at lightning speed and punched into the control tape.

A summary of the system so far: New blueprint is revised with dimensions taken off three reference points, X, Y and Z representing longitudinal, transverse and verti-

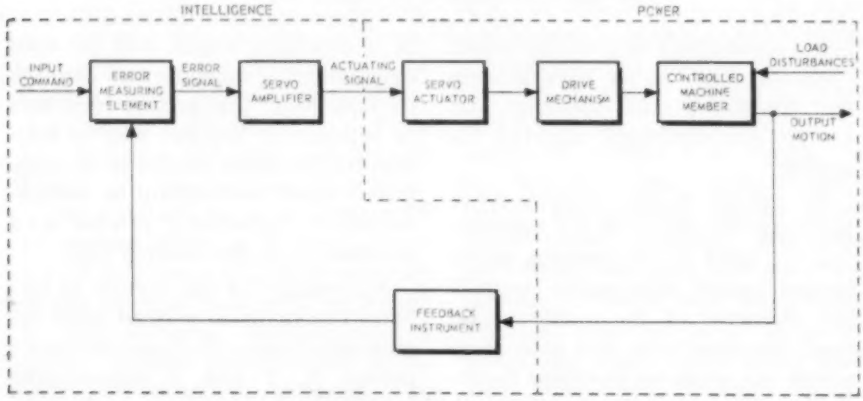
continued

cal dimensions. This information is placed on process cards in orderly fashion and then transferred to the process tape by means of punched holes. This tape is merely an intermediary between the process cards and the computer. It is fed into the computer where all the information on the process tape is coordinated and this information is punched into a new tape, called control tape. It is from this strong, usually plastic, tape that the machine tool will receive its commands. All punched process tapes must go through a computer of some sort where the information contained thereon is calculated, taking into consideration speeds, feeds, length of cuts, depth of cuts, etc.

At this point someone is certain to bring up the subject of cards instead of tape, and magnetic tapes instead of punched tape. This should be of no concern, some like chocolate and some like vanilla ice cream. It's all ice cream. As a matter of fact, the physical means of recording and storing data can be broken down to the following:

1. Punched cards.
2. Punched tapes.
3. Magnetic tapes.
4. Templates.
   a. 2-dimensional.
   b. 3-dimensional.
5. Drawings for photo-electric template followers.

You will remember we discussed the dimensions which we took from the blueprint and transferred to process cards. Do you know how many methods there are of recording data? You can use binary, binary decimal, decimal, reflected binary, voltage, pulse height or



4. Block diagram of a machine tool servo.

width, voltage amplitude, etc.

Each proponent of each system thinks his is the best, and in the face of absence of complete user data, which can be gathered only after a period of years, we cannot argue with them. However, these various systems do point up two important facts, the confusion which results in the users' minds when confronted with this array of systems and the difficulty of discussing them in one short article such as this.

Let us continue building our milling machine system. Incidentally, we did not pick this present system because we think it is the best of all possible systems, but because we feel it was easily understood.

The computer, into which the process tape is fed, calculates the feed rate information, computes the cutter-center offset, generates the intermediate points, and finally punches a control tape which contains a coded representation of incremental tool movement from one intermediate point to the next in the desired sequence.

Since, in the particular system we're discussing, the machine control unit performs linear interpolation between the intermediate points, the computer is required to calculate these points along the curved path so that the finished part is within the specified accuracy or surface finish.

One more word about the function of the computer. The process tape may contain a number of punched holes to, let's say, define a curve. To make the curve better defined the computer calculates the balance of the curve and punches additional holes. The computer thus punches enough holes to enable the machine tool to eventually perform its work. In a general way we may say that the process tape contains the rough bone structure of what is wanted; the bone structure suffices for the computer to calculate the location of muscle and flesh so that the whole man results. The process tape says, feed five inches; the computer calculates the feed, speed, allows for cutter diameter, etc., and punches sufficient holes in the control tape to enable the machine tool to understand and follow the command.

So far all activity has taken place in the office. The process and control tapes can be miles away from the shop floor. Now we can either store the finished tape until this job is ready to be placed on the machine or we can hurry right down to the floor and try out the tape the computer has punched and try to remove some metal via the tape.

There are two units in the shop, the machine control and the machine.

The machine control unit contains the brains of the system while the machine is the brawn. The tape is read by the machine control unit just one step prior to the machining

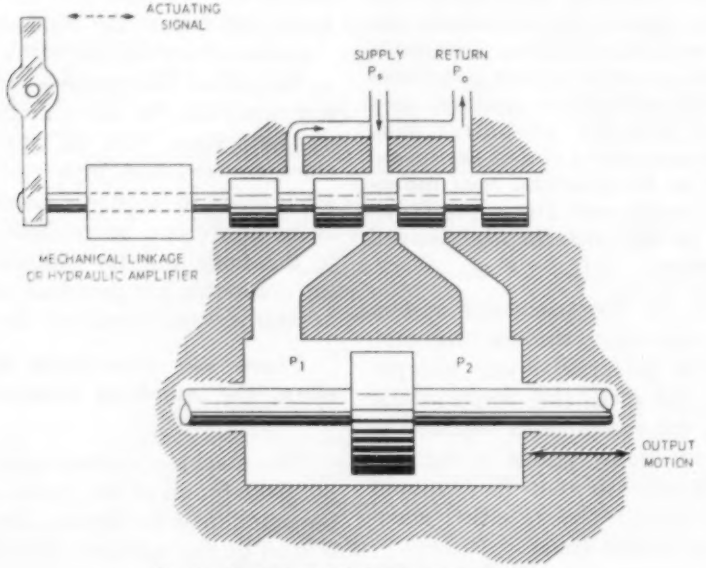
continued

operation. The information is stored in a buffer unit and is sent out by an interpolator in the form of electrical pulses simultaneously to the three axes (longitudinal, transverse, vertical). Both buffer and interpolator are housed in one unit.

The major function of the interpolator is to send out the signals smoothly and continuously. Remember, from our punched tape via the holes punched into them, the electrical signals are jerky. For this reason all the signals are stored in a buffer and released by the interpolator in a continuous signal to eliminate all jerkiness. So the reading of the tape always is a little ahead of the machine movements; as a matter of fact, it is about two inches of tape ahead of the machine operation.

Here we get into further variations of systems. Sometimes the computer provides for interpolation and signals commands directly to the machine tool. Sometimes the computer feeds into the interpolator with the interpolator providing the final means which directs the machine. In some of these cases magnetic tape is used.

The signals now go from the in-



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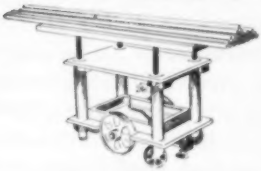

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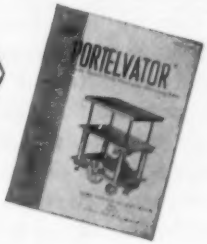

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continued

terpolator through an error register, and then to the servo-mechanism which controls the machine movement. A servo-mechanism is something we hear a great deal about. It is no more than a small unit which receives the signal and magnifies it and transforms it into electric-hydraulic power. This power is then metered out and transmitted to the respective machine members. So, simply speaking, a servo-mechanism is a power device which will respond to a small signal. *See figure 3.*

An illustration will describe both servo-mechanism and feedback both at the same time.

Your brain sends a tiny, hardly measurable, signal to your arm to raise itself to a horizontal position. The muscles in your arm begin to contract (the servo-mechanism which amplifies the signal and actuates the muscles, is at work) and raises the arm until it is horizontal. After it has attained a horizontal position it stops. Why? Because you, through your eyes, have sent a tiny impulse back to the brain telling it that the arm is in the desired position and the brain sends the impulse back to the arm telling it to stop. So the signal is flashed from the brain to raise the arm, the servo raises the arm, at the required height the signal is fed back to the brain that the arm is correct and the command is flashed to the muscles to cease their work. Command signal, servo-mechanism and feedback have been at work, *see figures 3, 4 and 5.*

At this point it might be interesting to introduce the subject of feedback into the machine tool we are discussing. On the machine, and operating with the various machine members, is a quantizer. This little fellow keeps flashing back to the error register how we're doing on the machining end. It sends this information back to the error register. It is called a feedback pulse. For each .0002-in. of travel of the machine member a pulse is sent back to the error register. The original signals are passed through the error register to the servo to actuate the machine tool. In the error register the command signal is compared constantly to the feedback pulse.

So we have this simple little procedure: Let us assume we want the transverse slide to move 5-in. This signal, to feed a certain distance, is transmitted to the error register. All the time this signal is being transmitted the quantizer is sending back (from the transverse slide) little electrical pulses. Each pulse measures .0002-in. It can readily be seen as the .0002-in. pulses (in electrical form) reach the error register there is suddenly a big difference between the .0002-in. pulse and the 5-in. signal—a big difference. And

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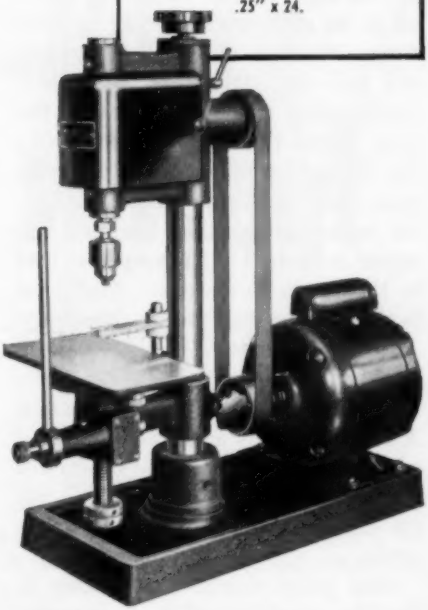

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continued

this we can't have. Consequently, great activity now takes place; the error register flashes to the amplifier that a big difference exists and we must not allow this. The amplifier receives this signal and flashes this news to the servo. The motor speeds up, the slide begins to move, all in an effort to close the gap between the 5-in. of command to travel and the little .0002-in. pulses. As the slide reaches the end of the 5-in. travel the difference between the 5-in. command signal and the quantizer feedback pulse of .0002-in. becomes less and less and the signal is flashed to the amplifier and to the servo to go easy. And soon both signals will be in harmony. About this time a new signal is flashed to the error register: Move the cutting tool vertically 3-inches. A big gap exists again between the command signal and the quantizer feedback signal of .0002-in. So we go through the whole business again.

One point worth mentioning is that the word "error" in error register or the "error" impulse sent to the servo amplifier is not an error in the sense that the impulse is wrong or bad; it should not be compared to the error of a first baseman dropping the ball. The word really should be "differential" or a similar term to describe a difference between the strength of two signals. With the development of numerically controlled machine tools a vast and bewildering jungle of technical words has been sprung upon us, words with which many of us are not too familiar.

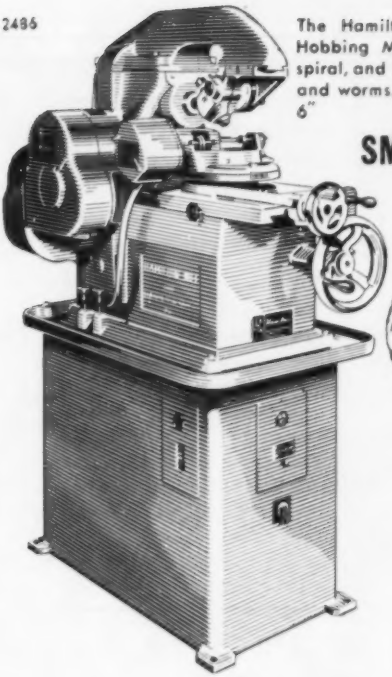
To further clarify the functions of quantizer, its feedback pulse, comparison of error in the error register and the error signal which is flashed to the servo amplifier, let us compare this to our arm raising story.

The brain merely signals the arm to raise to a horizontal position, but it doesn't actually know when the arm has reached its position. To prove this, close your eyes and raise your arm exactly 7 inches above the horizontal. You can come close, but not absolutely accurately. To overcome this, throw the quantizer on the subject, your eyes. The eyes will return a steady signal back to the brain telling it that it's getting close, closer, slow down, etc. The signal from the eye is compared to the signal from brain to arm and when the two match up you've arrived. This is crude, of course, but it serves to illustrate the function. It is called a closed loop system.

The quantizer we've been discussing sends an impulse for every .0002-in. of machine member travel. In some installations the pulses result from .0001-in. or .0005-in. of travel, depending on the system.

And sometimes it's not even called a quantizer at all, but some-

2486



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thing else. This field has not yet standardized, it's much too new; not enough field tests have been made to determine which system is best for what job. But like all worthwhile things, it will shake out, standards will appear in function as well as terminology, and all of us, before long, will know much more about the field.

And so we've built a numerically controlled milling machine. The steps are simple. The basics are easy to understand; the thinking that went into its manufacture is not so simple. However, the manufacturer of the system is concerned with the technical detail.

To summarize the building of our milling machine:

In the office:

1. Translate the blueprint into logical numbers with reference points.
2. Put the information on process cards including cutter size, etc.
3. Punch the process tape, recording all information from the blueprint.
4. Send information to computer.
5. Computer calculates all pertinent information and
6. Punches a command tape.

On the floor:

7. Punched tape placed in a reader which
8. Sends information to buffer and interpolator.
9. Interpolator sends signals to error register where
10. The signal is compared to a feedback pulse from the quantizer, the
11. Difference between the command signal and the quantizer feedback signal is sent to
12. The servo amplifier where the little signal is amplified.
13. The amplified signal actuates the servo electro-hydraulic motor and
14. The machine members begin to move and metal is removed.

• • •

WE ACKNOWLEDGE our indebtedness to Mr. W. C. Beverung, Aircraft Machine Tool Div., Kearney & Trecker Corp.; Mr. C. B. Sung, Bendix Aviation Corp. and his paper, Designing Machine Tools for Automatic Control, and Mr. Tracey E. Johntz, Chicago office, General Electric Co., and his paper, Servo and Feed-Back Principles Explained.

None of these experts reviewed this essay. Well take the blame for over-simplification and give the learned gentlemen above all the credit for its accuracy and value to our readers.

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CASE NO. 1

Chevrolet Passenger Transmission Div. of GMC, Toledo, Ohio

How Chevrolet

By **William F. Schleicher**
Vice Pres. and Editorial Director, Hitchcock Publishing Company

• Unquestionably one of the aspects of advanced mechanization which allows the manufacturer greatest range of imagination and which permits for utilization of available standard machines is the interlocked-integrated production

The First Station

BATTERY of 6 Cone automatic bar machines. This is the only location where the chutes go under the floor to a collection conveyor before they are elevated for the next station.

Produces Pinion Gears

. . . on integrated-interlocked line

line. Whether 2, 3 or 4 machines or 50 machines are hooked together like beads on a string the end benefits are the same:

1. Standard machines now in the plant can be hooked up with chutes, feeder lines, automatic gaging and sizing equipment to deliver a constant, high production.
2. Cost of this advanced mechanization is low, sometimes no more than from 15 to 25 per cent more than the cost of the machine tools alone.
3. Because these machines are now in the plant present personnel, who are acquainted with the equipment, can be used efficiently.
4. All the cost saving knowledge now enjoyed by the manufacturer's personnel in the fields of tooling, inspection, materials handling, machine utilization, etc. can be applied.

There are other advantages which can readily be grasped by pondering the problem for a few minutes.

As an example of forward-look-

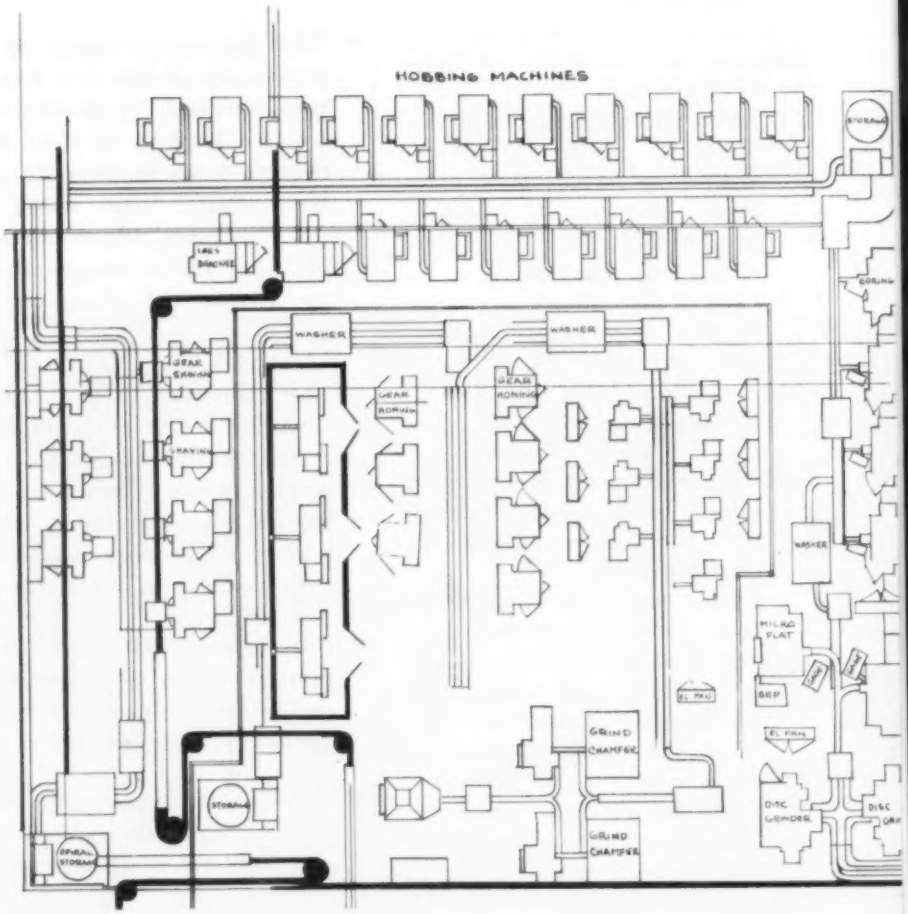
► The integrated-interlocked production line has been most successfully developed by the larger shops, although many smaller shops have similar lines, using a few machines, which are as efficient and as imaginative as those of their big brothers.

► The Chevrolet Pinion Gear line uses 62 machine tools, 5 parts washers and 4 spiral storage units. Chutes, conveyors, parts dividers, distribution conveyors and elevators unify the installation.

► Bar, honing, grinding, hobbing, shaving, gear honing and chamfering machines are included in the line.

► Machines are equipped with automatic gaging and sizing and feedback mechanisms.

Chevy's pinion gear line: careful



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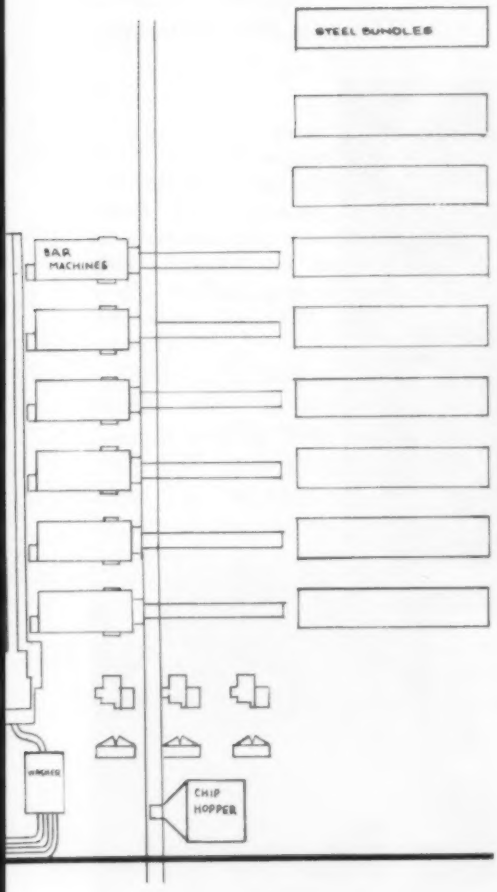
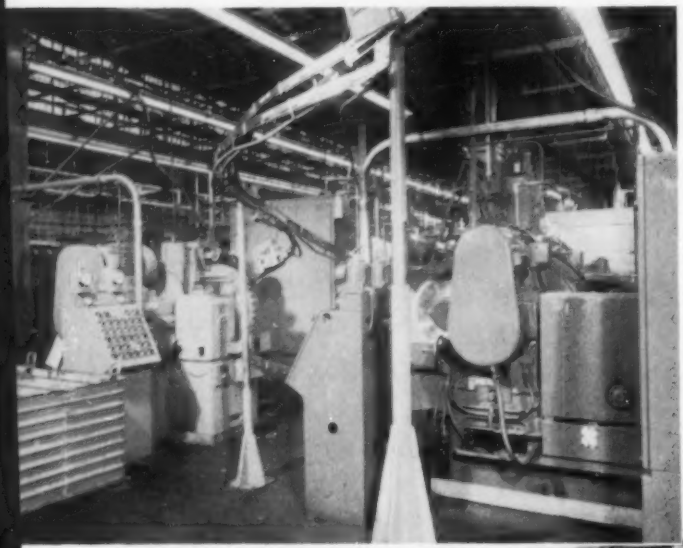
utilization of space, a compact line



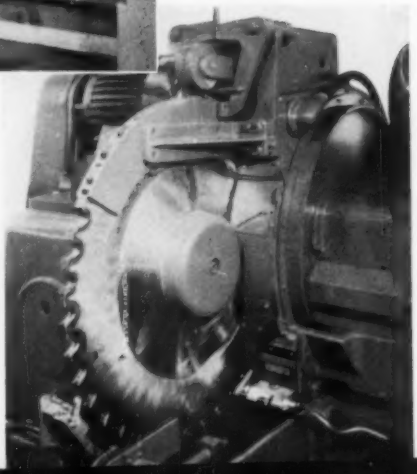
A roadmap of the pinion gear line showing arrangement of machines and chutes. Note the careful utilization of space and the compactness of the line. While all lines are through-feed, the line serving the gear honers is not of the through-feed type. Here the parts are returned, via chute, to the starting position. This arrangement was dictated by space considerations.

continued

ing production through the use of the interlocked-integrated line the Chevrolet Passenger Transmission Division, General Motors Corporation in Toledo, Ohio, is an outstanding case of cooperation between manufacturer, builders and designers. This is the pinion gear line where a production of 1200 per hour is achieved. The line utilizes feedback, automatic sizing and gaging, integrated parts washing and spiral storage units. The production process encompasses 62 machine tools, 5 parts washers and 4 storage units. The automatic equipment is electrically controlled and completely separate from the machine tool builders' electrical panels. This was done to simplify



THE SECOND STATION where faces are ground. At the top center of the photo, note a two-way divider which feeds the two Gardner grinders.



Closeup shows disc grinders of station 2 without the chutes. The Sheffield gaging equipment measures the location of the faces of the parts relative to a centerline established by the carrier and chain.

the electrical interlocking and aid in possible electrical trouble shooting.

This line produces pinion gears for the Rear Planetary Gear Assembly and Front Planetary Gear Assembly.* Altogether 10 gears are located in these two assemblies. In addition, four oil pump gears are also manufactured on this line. The gears are used in the Chevrolet automatic transmission.

The conveyors, chutes, elevators and parts dividers were manufactured by the F. Jos. Lamb Co., Detroit.

The production process initiates from 6 eight-spindle Cone Automatic Bar Machines. Bar stock in 12-foot lengths are loaded into the machines and the gear blanks are turned on the O.D., drilled and reamed, chamfered on the O.D. and I.D. and cut-off.

Dimensions and tolerances of the blanks after this operation are: Length is .894/.886; O.D. is .950/.955; I.D. is .4945/.4955-in. Maximum I.D. to O.D. run-out equal to .005-in. The material is 5130. The bar machine ejects the blanks from a tube in a sliding position. The blank is caught, reoriented to a rolling position and rolled to a collection conveyor located beneath the floor. The blanks are conveyed to an elevator, elevated, and fed to a parts washer.

The gear blanks upon leaving the parts washer are divided into two lines of parts flow by a two-way divider and processed through 2 Gardner grinders where two ends are ground parallel to within .0003 T.I.R. Dimensions are .8775/.8765-in. During the operation the part is held in place by a U-notched rotary carrier with chain hold-down and passed between the abrasive discs. The blank is passed between two gaging cartridges which measure the location of the face relative to the centerline established by the carrier and the chain. As the dimension approaches the maximum limit, due to wheel wear, the wheel slide is automatically infed to compensate. The rotary carrier has vari-speed drive. A swinging arm dresser is automatic air-hydraulically operated. The lubrication system is centralized. A Barnes drill magnetic separator is used. The gages are by Sheffield.

The parts are discharged into flexible chutes to blenders and then to an elevator to be elevated for the next operation in a single line of part flow.

After leaving the elevator the gear blanks are divided into two lines by a two-way divider and processed through 2 Micromatic Hone Microflat machines. A horizontal trunnion fixture is used. Slots are provided in the fixture for the

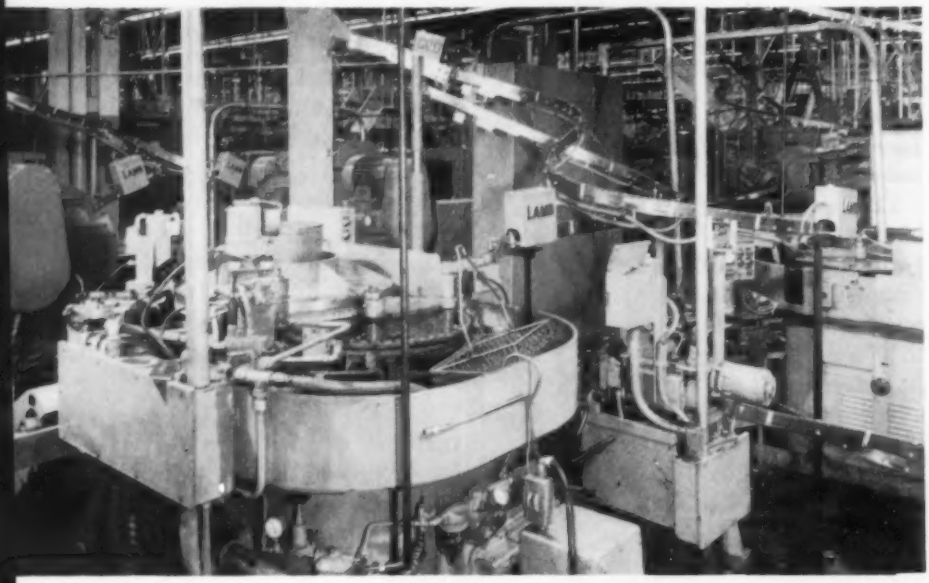
*On the automated line only pinion gears are manufactured. Sun gears and oil pump gears are produced on machines of similar nature but without the connecting chutes and gaging devices. This is for later installation.

continued

blanks which are then carried between two opposing plates. As the lapped parts leave the machine they are checked by automatic gages. If parts are undersize or oversize the gage automatically, through feedback, corrects the height of the lapping plates so that the error is corrected. The plates begin to correct after three pieces have shown error; after five bad pieces the machine shuts down. The faces on the part must be parallel within .0003-in. T.I.R.; dimensions and tolerances are .8755/.8745. Finish requirements on the faces are 30 microinches.

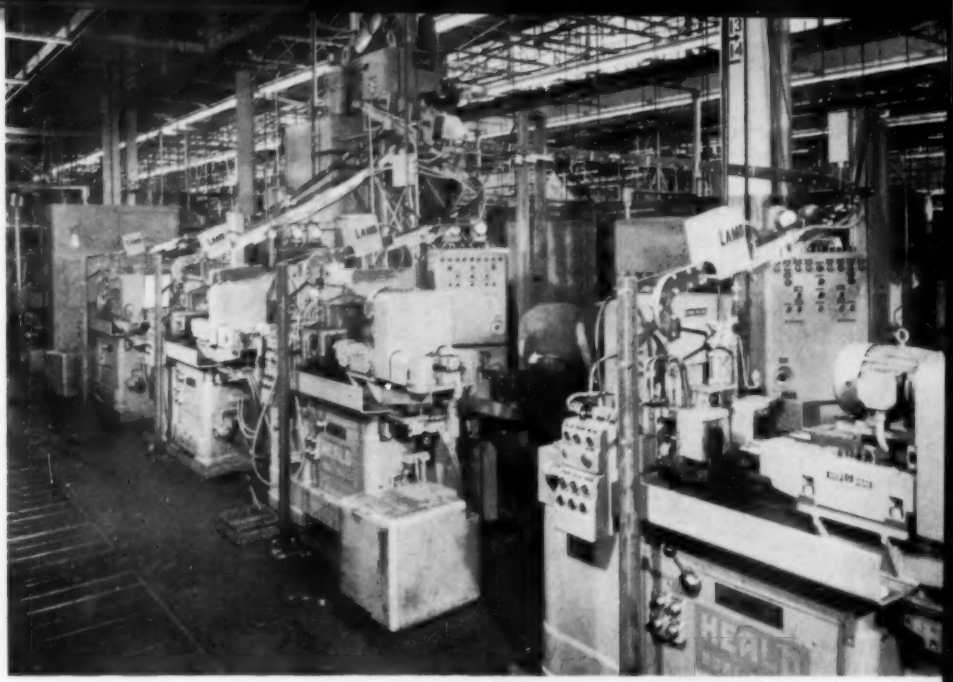
The parts are then discharged into Lamb reorienting units in a sliding position. The blanks are oriented into a rolling position and discharged into flexible chutes from whence they roll to a blender and then to an elevator to be elevated for washing.

The gear blanks upon leaving



Lapping Gear Blank Faces

At the third station 2 Microflat machines lap the faces of the gear blanks. The line switch box is clearly visible in the center of the photo. This line switch, of which there is one at every machine, prevents parts from clogging up the machine in case of tool breakage. A feedback mechanism is built into the gaging equipment which compensates for undersize or oversize parts.



The Boring Machine Line

The Heald boring machine line of which a schematic sketch is shown on the following page. Exit from the machines is at the rear; the 4-way divider can be plainly seen top center of photo.

the parts washer are divided into four lines of part flow by a Lamb four-way divider and processed through 4 Heald Boring machines. The sketch shows a side view of the parts washer, divider and arrangement of chutes to the Healds.

The boring of the I.D. is interesting for its feedback mechanism.

The work is held stationary because of the WR^2 involved. Boring takes place on the "out" stroke with the tool in a retracted position on the "in" stroke. Parts are shuttle fed to two spindles and are located against one end and clamped against the other, a loading plug picking up each part from the loading chute and placing it in the chuck.

Because of the production requirements and the integrated line layout of the equipment continuous production was a necessity.

Down-time had no place in the planning of this line. This naturally placed a burden on the boring operation where tool wear on steel must be reckoned with.

Auto setting of tools signalled from an after gaging station is difficult enough on a stationary tool holder, but when the tool is rotating continuously it becomes a real problem. Furthermore, it became

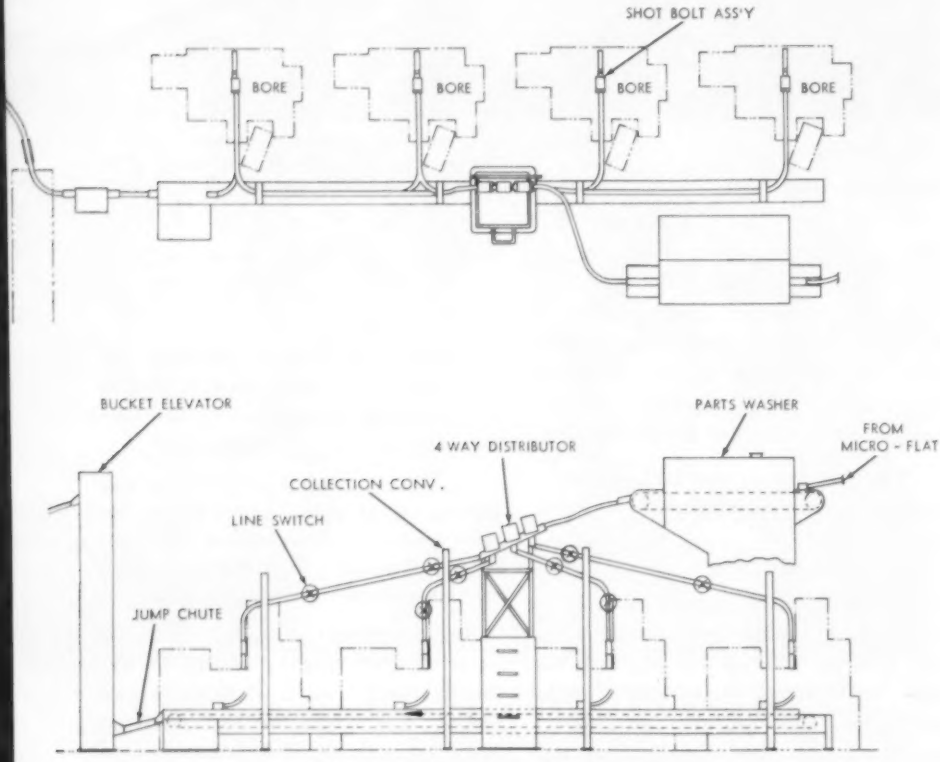
continued

necessary to find a small motor having a symmetrical gear train capable of being balanced to rotate at high speed and not cause an out of balance condition.

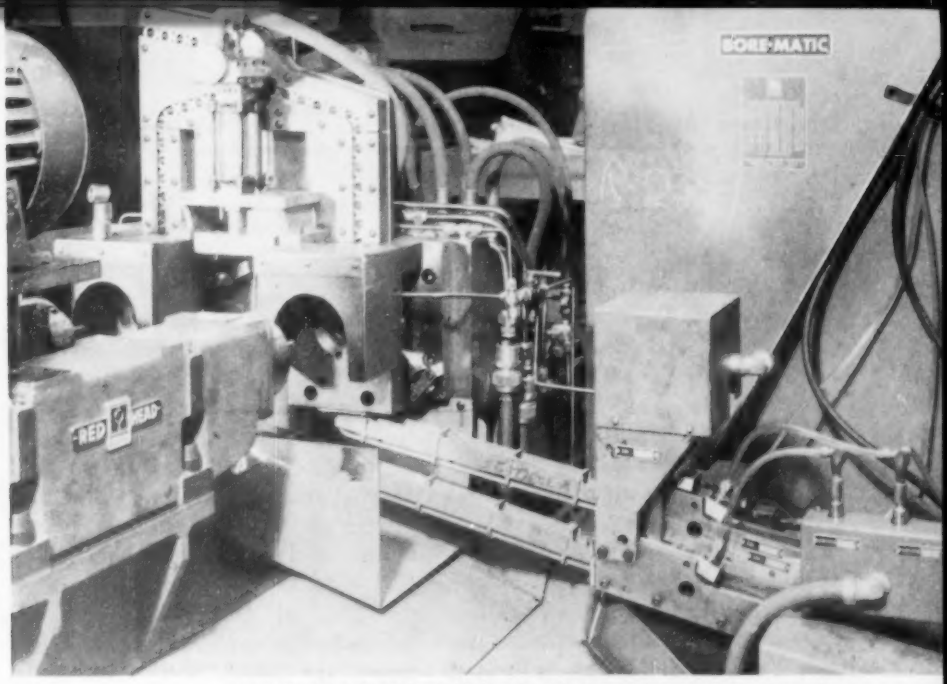
The main design of this feedback unit is the successful combination of tool retraction and tool adjustment in a common unit. The draw rod is moved laterally for retraction and rotated by a little 10 rpm gear motor for tool setting. A friction clutch is provided between the motor and rod to permit the motor to rotate continuously.

The spindle is mounted on a 1/2 deg. angle. Feedback is accomplished electrically.

The surfaces must be square with the bore within .0003-in. T.I.R. Di-



Schematic sketch of the Heald boring machine line.



CLOSEUP OF THE BORING MACHINE with the loading chute removed. Parts are presented to two spindles; after the boring operation the parts are combined in one chute for presentation to the next operation. Stock removal on this operation is .008-.010-in. A tolerance of .0005-in. is maintained.

mensions and tolerances of the bore are .5053/.5040-in.

The gears are discharged into a collection conveyor from whence they go to a storage unit which stores 4000 gear blanks in a rolled oriented position. Then into the elevator to the next operation.

After passing through a distribution conveyor the blanks are distributed to 18 Cleveland Hobbing Machines and 2 Lees Bradner Hobbing Machines.

The machines are offset in relation to the feeding conveyors. The hobbing machines cut the gear tooth form in the gear blanks. Each gear is washed, then gaged and discharged to a collection conveyor.

The two Lees-Bradner hobbers are equipped with automatic sizing control. The hob and the slide are both adjustable according to signals from the inspection unit.

The gears are then distributed to 7 National Broach Shaving Machines where the teeth are shaved and each gear checked individually. From here the gears are sent to the heat treating department to be hardened.

Upon returning from heat treating the hardened gears are dumped into a bulk storage and orienting unit which automatically feeds and orients the gears in a single line

continued

part flow to an elevator and to the next station.

The heat treated gears, after leaving the bulk storage, are divided into two lines to two F. Joseph Lamb Chamfer Grinding Machines. These machines grind a chamfer on the acute edge of each tooth form on each face of the gear. This is an interesting machine and is worth a closer look.

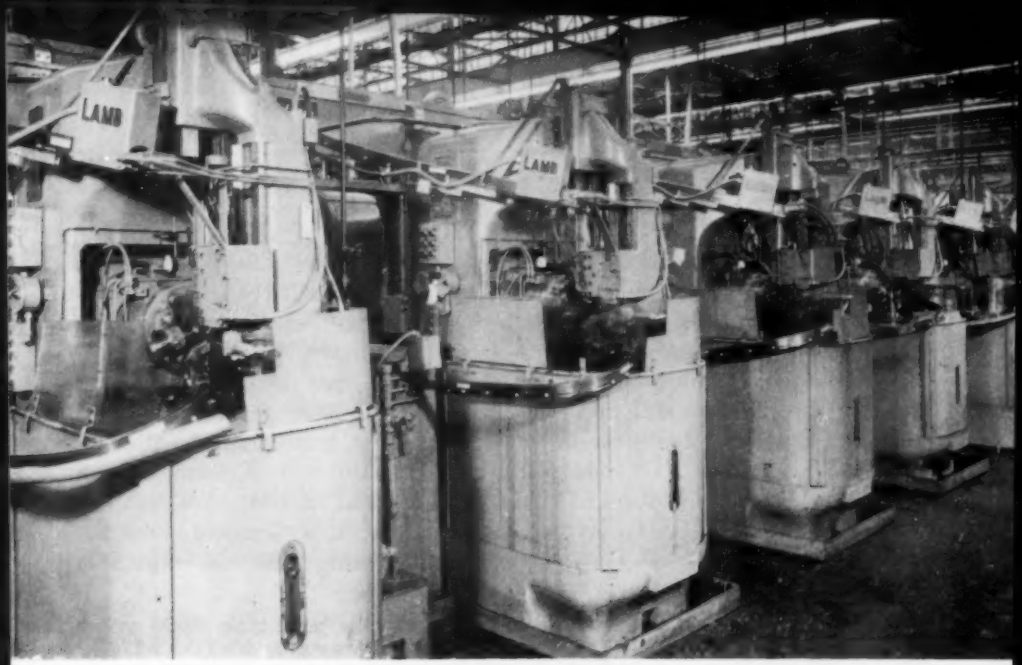
One production machine is capable of grinding chamfers on the teeth of helical gears, on both sides, at the rate of 900 to 2100 pieces per hour. The production rate is limited only by the diameter of the gear, and is independent of the number of teeth.

The part is fed onto the first of two continuously running feed belts by a cam regulated air cylinder, where it meshes with a rack which is aligned with the crush formed grinding wheel. This rack controls the amount of stock removal and produces a generative cutting action between the part and the wheel as the part progresses through the machine. At the end of the first feed belt the work is automatically turned over and placed on a second feed belt, where the operation is repeated and the work is then automatically ejected. Loading and ejecting is automatic.

In general these machines are used to remove machining burrs left on the root and acute angle side of the gear tooth profile. However, should a chamfer be required around the entire gear tooth profile it can be accomplished provided the helix angle is not excessive.

From the gear chamfering operation the gears are elevated to a distribution conveyor and distributed to 8 Micromatic Honing Machines where the I.D. of the gears are honed and checked for size. The I.D. must be concentric with pitch diameter of gear within .002-in. T.I.R. Inside dimensions and tolerances are .5041/.5046 with a 10 microinch finish on the I.D. These machines are equipped with "post process" gaging. The part, after honing, is positioned below an air gaging spindle and is inspected during the interval in which the following blank is being honed. Again, segregation of parts is accomplished in two classes: reject and acceptable. Should a predetermined number of consecutive parts be rejected the machine cycle is stopped and an operator may note the amount and direction of error on the indicating dial and make a manual adjustment on the tool prior to recycling the machine. When the stones become worn, the machine shuts down.

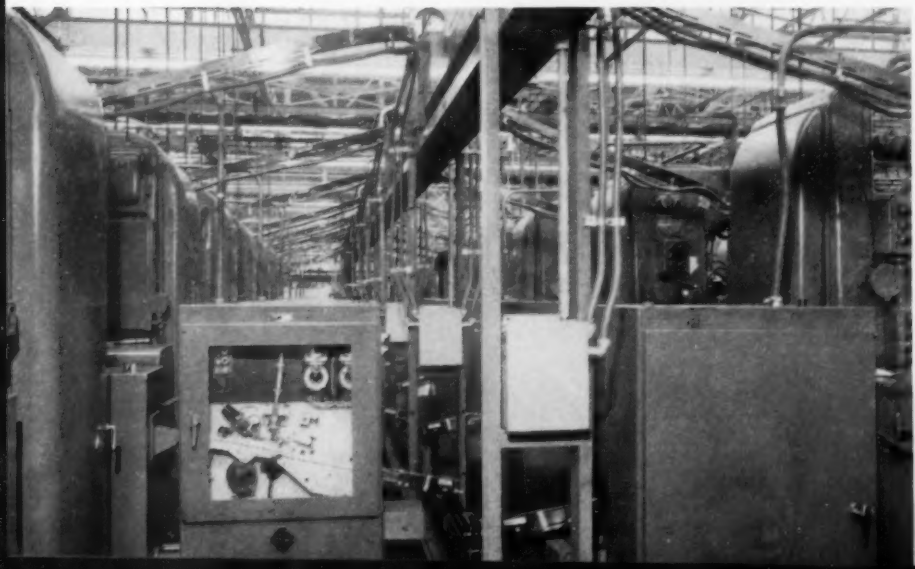
Again the parts are elevated and pass through a parts washer before being released to the distribution



Here gears are hobbed into the blank by a battery of 18 Cleveland hobbing machines and 2 Lees-Bradners. The parts are washed after the hobbing operation and then gaged. Machines, with the exception of the 2 Lees-Bradners, are not equipped with feedback and automatic control of size.

How Gears Are Hobbed

REAR VIEW of the Cleveland hobbing machines shows the inspection unit. The travel of the parts is indicated by the dotted lines in the unit. Inferior parts are discharged into the pan at the right of the unit; good parts continue their travel to the next station.



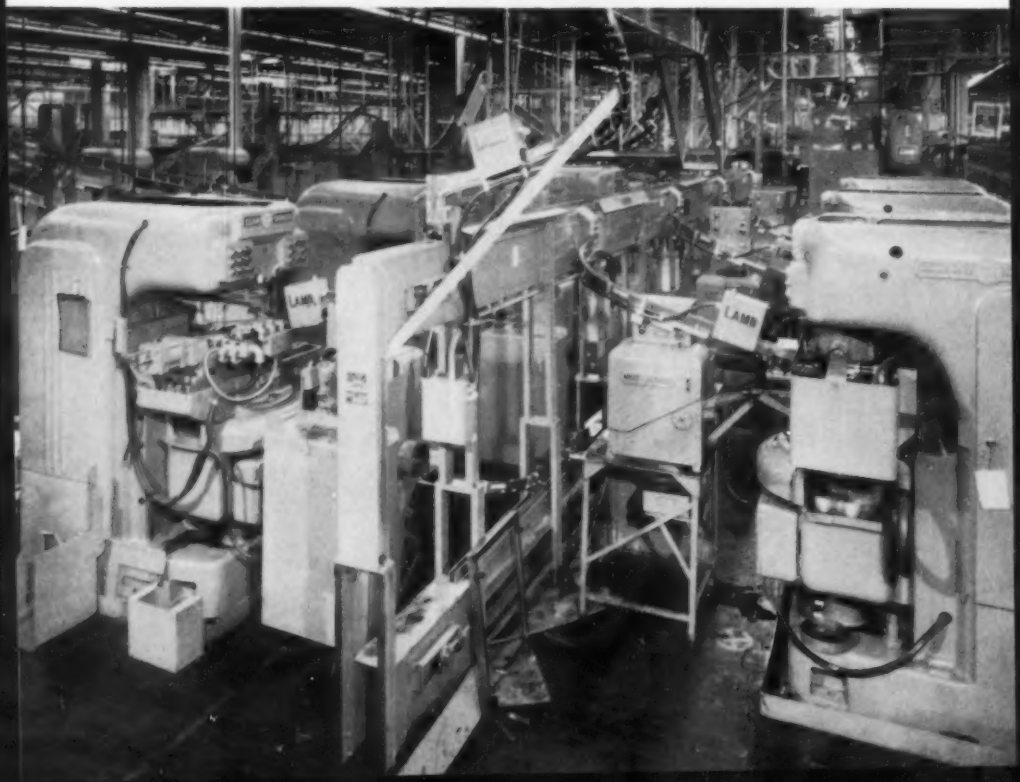
continued

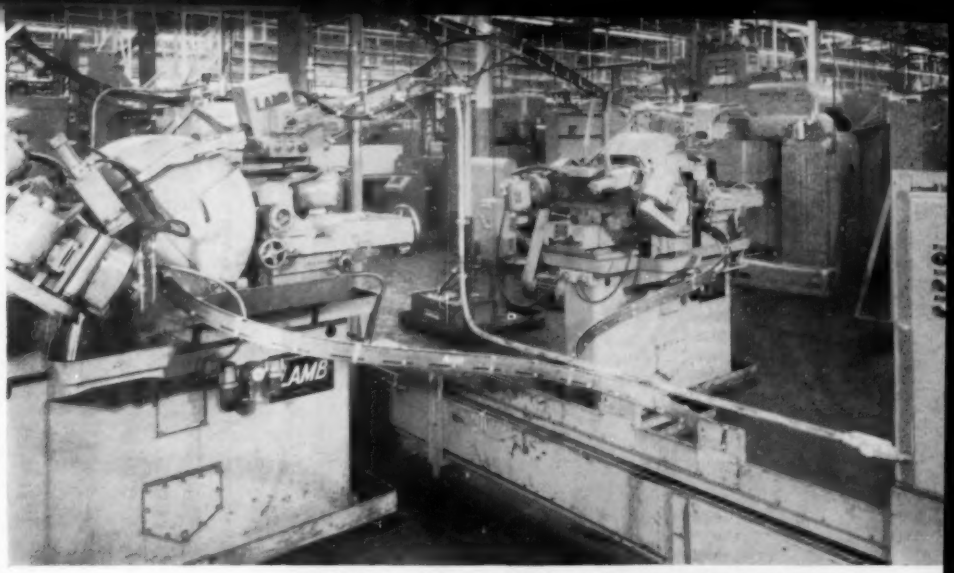
conveyor which distributes the gears to 8 National Broach Hard Gear Finishing Machines where the gears are honed. This is a relatively new development by National Broach. (A thorough discussion of this process will be found in the October, 1956, issue of GRINDING and FINISHING magazine, sister publication to MACHINE and TOOL BLUE BOOK.)

The heart of this gear honing process lies in the honing tool which is essentially an abrasive-impregnated helical gear that is run in mesh with the hardened gear in crossed axes relationship at high speed. The honing tool, or wheel, is a plastic impregnated with silicon carbide and is formed in a master mold of the same material as the wheel. Somewhere along the manufacturing line the wheel is

The Gear Shaver Line

The parts, after leaving the machine, return to the starting position at the front of the machine. Before passing into the chute, after machining, the parts are checked. Automatic controls shut down the machine if a specified number of parts are bad.





Gear Chamfering

This is the Lamb gear chamfering machine where chamfers are ground on the acute edge of the gear form. The part is fed into a continuously running feed belt; after one side is chamfered the part is automatically turned over and the other side is chamfered.

"cooked." Wheels are furnished in varying grits; a 10 micro finish is obtainable with an 80-grit wheel.

After this operation the parts are fed into an elevator and through a parts washer after which they are divided into three lines of part flow by a three-way divider and processed through 3 National Broach Sound Checking Machines where the gears are checked for objectionable noise. Then they are discharged to a collection conveyor, go to an elevator and fed into a spiral storage unit which stores 4000 gears in a rolling oriented position. At this point the gears become ready for final assembly.

The problems of electrical interlocking and the prevention of part flow to successive operations, when those operations cannot accept parts because of a loaded condition, was solved by Lamb Company's development of electro-mechanical line switch and shot bolt.

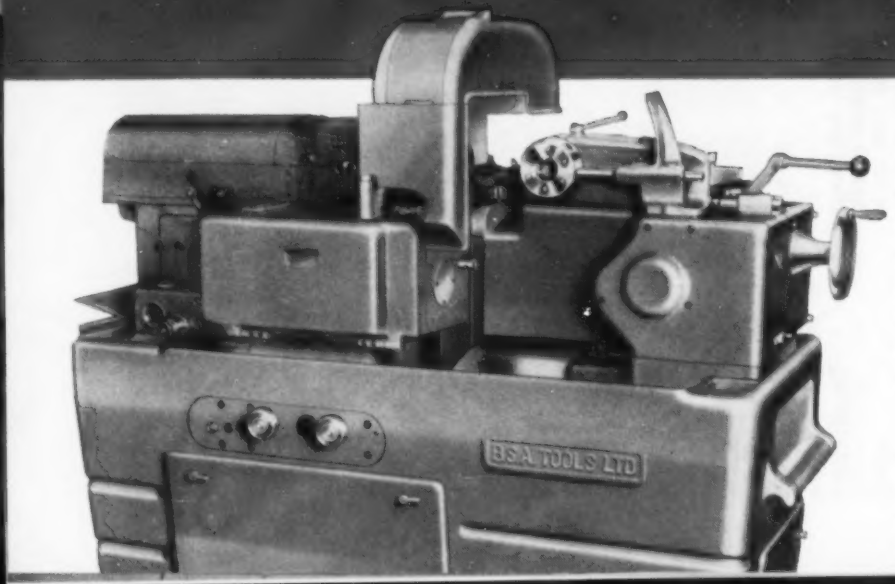
This fastens directly to the flexible chuting and becomes an integral part of the chuting. It is thus possible to cease the flow of parts at more than a dozen spots in the part-flow line. Slip-clutch arrangement prevents damage to the units in case of jams.

Flexible chuting of hardened stainless steel construction solved the problem of attaching connecting chutes to the various machine tool chutes that move as much as six inches during their normal cycle. This chuting simplified the installation of the machines as it

BSA

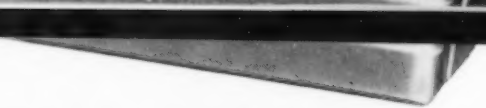
first to provide UNIT REPLACEMENT of parts subjected to most wear

to keep important production flowing with new machine performance



With speeds, machining accuracy, ease of tooling and operation and maintenance equal or superior to any machine in its classification, BSA Single Spindle Automatic Screw Machines offer a very definite plus value through *"unit construction and replacement"* of work spindles, side slides, turrets and gear boxes.

Unit construction, plus extremely rigid, one-piece machine frame makes it possible to bring BSA machines back to factory standards of perfection quickly. You place an important unit back in the line with a



Additional Production Advantages of BSA

FIVE STANDARD CAPACITIES: ½" ¾", 1", 1⅝", and 2".

WIDE RANGE OF SPINDLE SPEEDS—200 to 6000 on ½" machine, 69 to 1260 on 2" model.

Cams, change gears and tooling easily accessible FOR QUICK JOB-TO-JOB CHANGEOVER.

Unit construction provides quick access for EASY MAINTENANCE.

Special spindle mounting, DESIGNED TO REDUCE WEAR.

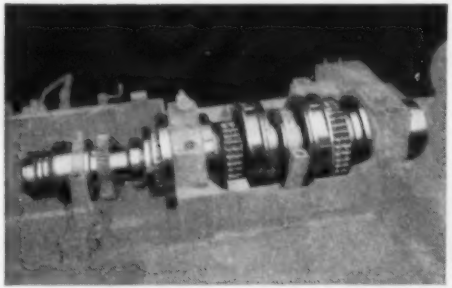
Positive chain drive from gear box to spindle PREVENTS SLIPPAGE.

All models use STANDARD AMERICAN TOOLING

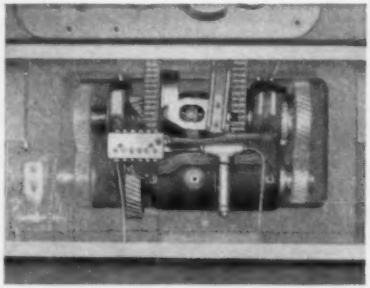
speeded to you from National Acme, in Cleveland. Here, also, full engineering and design services as well as demonstration and service facilities, in the National Acme tradition, are available to you.

May we explain how "*unit construction and replacement*" can ease your production problems?

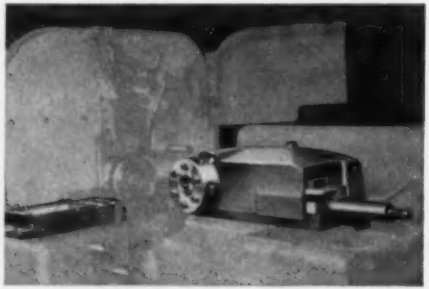
UNIT CONSTRUCTION SPEEDS REMOVAL OR REPLACEMENT



Work Spindle



Gear Box



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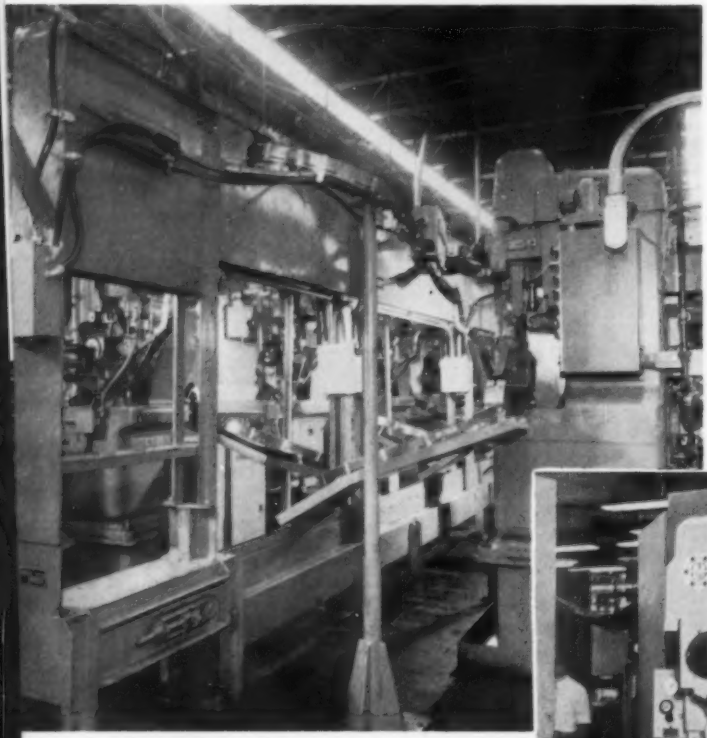
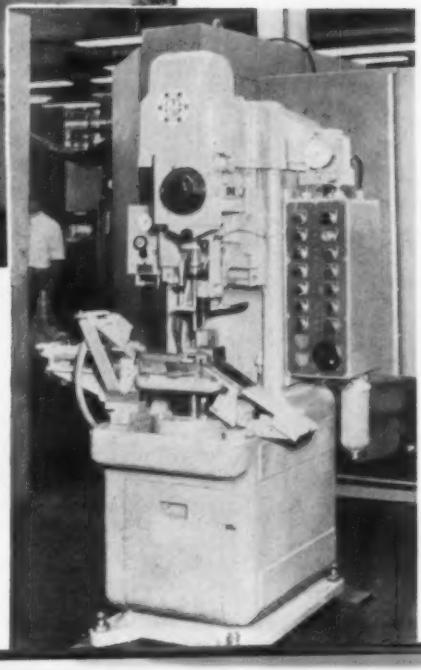
continued

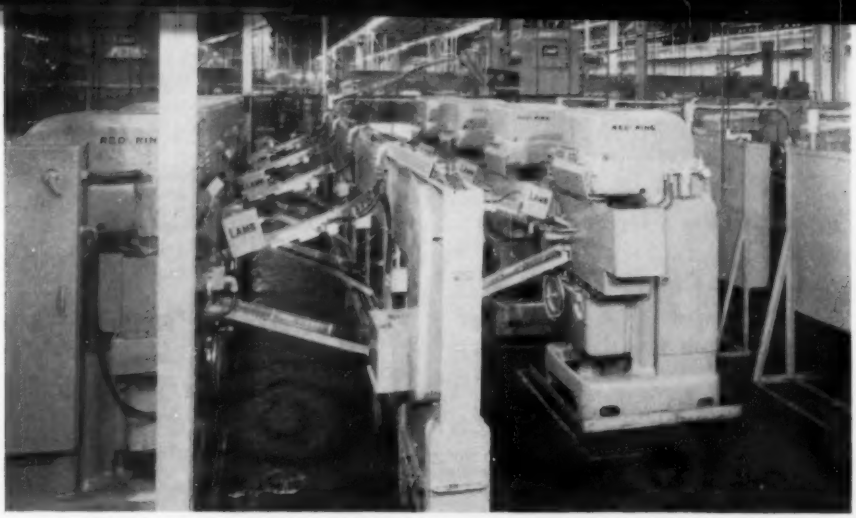
conformed to any desired contour and obviated the necessity of inflexibility, placing the machine tools in prescribed locations.

All in all, the installation shows imagination in the use of standard machine tools on a part which is ideally suited for this particular ar-





ABOVE: A view of the honing stations. RIGHT: A close-up of the honing operation with the chutes removed. Sheffield equipment automatically gages and sizes finished parts. Through feedback any error is signalled to the machine and the honing tool automatically adjusts itself.



ON THIS GEAR HONING STATION all gears are honed for quiet, smooth performance. As in the previous gear shaving line the parts return to the starting position at the head of the machines before being fed to the next station.

rangement. However, other parts of more complicated shape have been successfully produced with the help of chutes, feeding mechanisms and interlocked-integrated standard machines. • • •

ACKNOWLEDGMENT

In preparing material for these two Chevrolet reports we wish to thank and acknowledge the following persons for their splendid courtesy and help: Messrs. G. Swift, C. R. Moore, A. H. Eggleston, J. W. Barrell, T. J. Joslin of the Chevrolet-Toledo plant; J. L. Cutter, Chevrolet-Central Office, Detroit; C. R. Lindell, the F. Joseph Lamb Co.; D. A. Mackay, Jr., Heald Machine Co.; Frank Domke, Gardner Machine Co., Beloit; Robert Kimble, Autometrology Dept. The Sheffield Corp.; F. E. Arnold, Jr., W. F. and John Barnes Co.

THE FINISH OF THE LINE: Gear checking and final storage before the parts are released to the assembly line.

Here's what's involved in producing transmission cases at Chevrolet with a 41-station transfer machine of unique design.

Chevrolet Passenger Transmission Plant

continued

By **Paul A. Meline**
Managing Editor

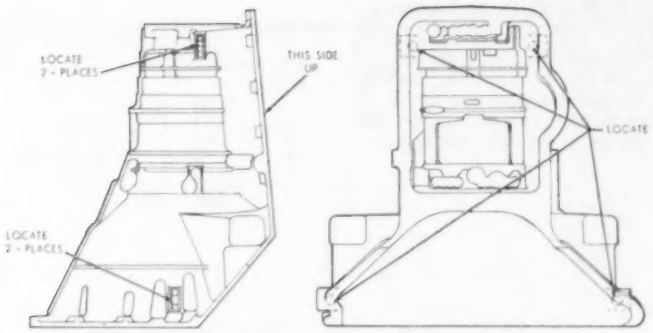
A 5-station rotary table indexing machine is required to ready the part before it enters the main line.

Transfer line is divided into 6 sections for easy control and maintenance. Special control panels make it easy to locate and correct trouble.

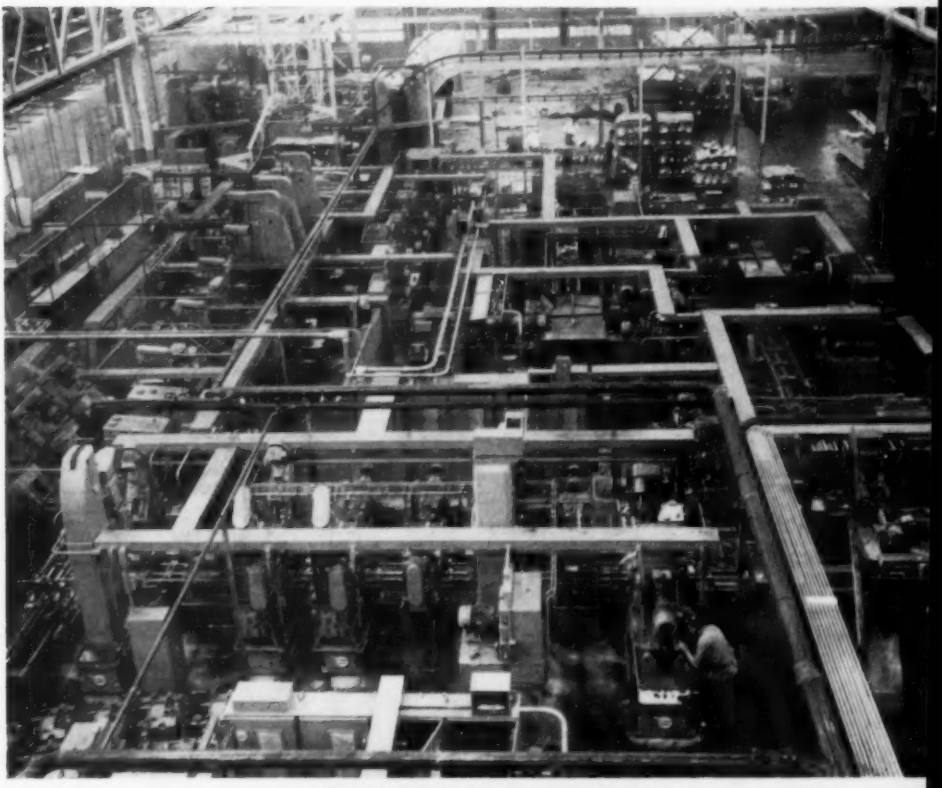
An idea of the size of the installation can be gained from this: 18,000 gallons of soluble oil circulates throughout the line continuously.

• An interesting example of a transfer type machine at Chevrolet's transmission plant in Toledo is the W. F. and John Barnes 41-station machine which performs operations on the transmission housing. The Chevrolet people pointed out several interesting aspects: At the beginning of the line a separate 5-station special machine readies the case for the line; the entire installation is divided into six sections for hydraulic, electric and assembly purpose. Each section has its own detector and panels on which trouble can be spotted immediately; at station No. 27, an idle station, the line breaks up into two sections to feed parts down two finishing lines for precision boring operation.

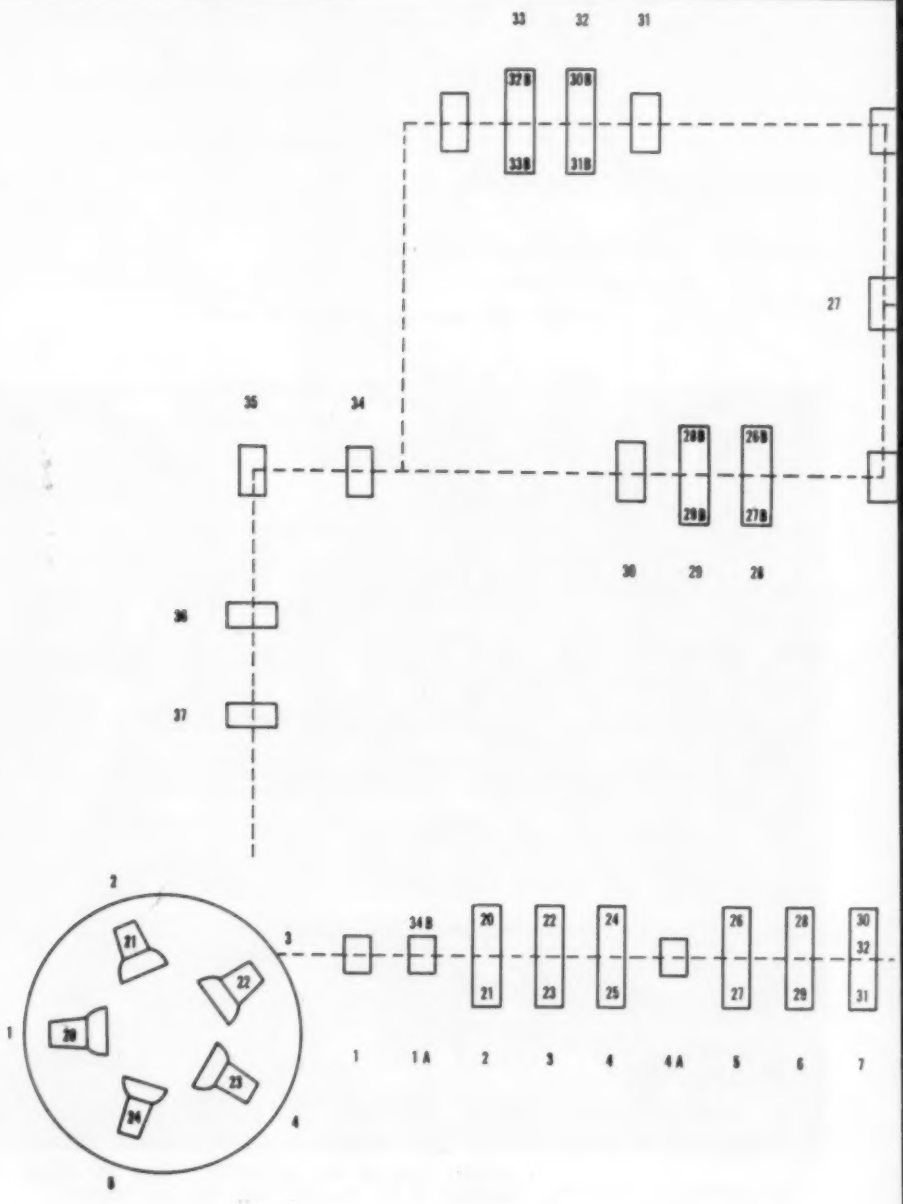
A roadmap of the transfer line can be seen on the following page. Here's an analysis of operations:



Drawing of part shows general shape and design.



OVERALL VIEW OF THE INSTALLATION. There are actually two machines at the Chevrolet plant. Both are identical.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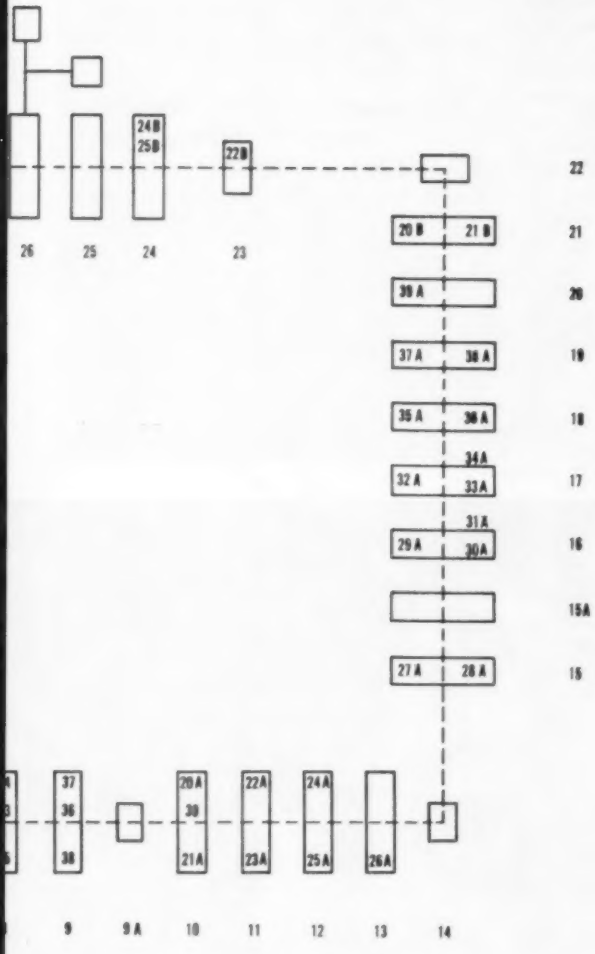
continued

ROADMAP OF THE TRANSFER MACHINE. A 5-station rotary table indexing machine is at bottom (left). Note how the lines divide after station 26. Boring operations take place on the two parallel lines. This design was made necessary to maintain the same rate of production from the boring heads as is realized from the rest of the line.



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5-Station Rotary Table Machine

5—Station Index Machine: This machine receives the rough (Aluminum 380) castings. Here (4) locating pads are milled and (4) holes reamed which serve as indexing points for subsequent operations by the transfer machine. The table is a 72 in. diameter rotary table of the Geneva motion type. The 5-station work holding fixture is mounted on an adapter plate; the part locates from inside of the casting with radial location to be taken from two cast lugs. Parts are manually located; equalizing jacks are manually operated. Clamps are operated by cylinders mounted at the locating stations.

The unit has a production of 90 at 80% efficiency and is based on production from station No. 2.

The Stations on the Rotary Table Machine

Sta. 1: Load and Unload.

Sta. 2, Unit 20: Mill (4) locating pads. (Self-contained hyd. unit mounted on 24-in. ways. 10 h.p.)

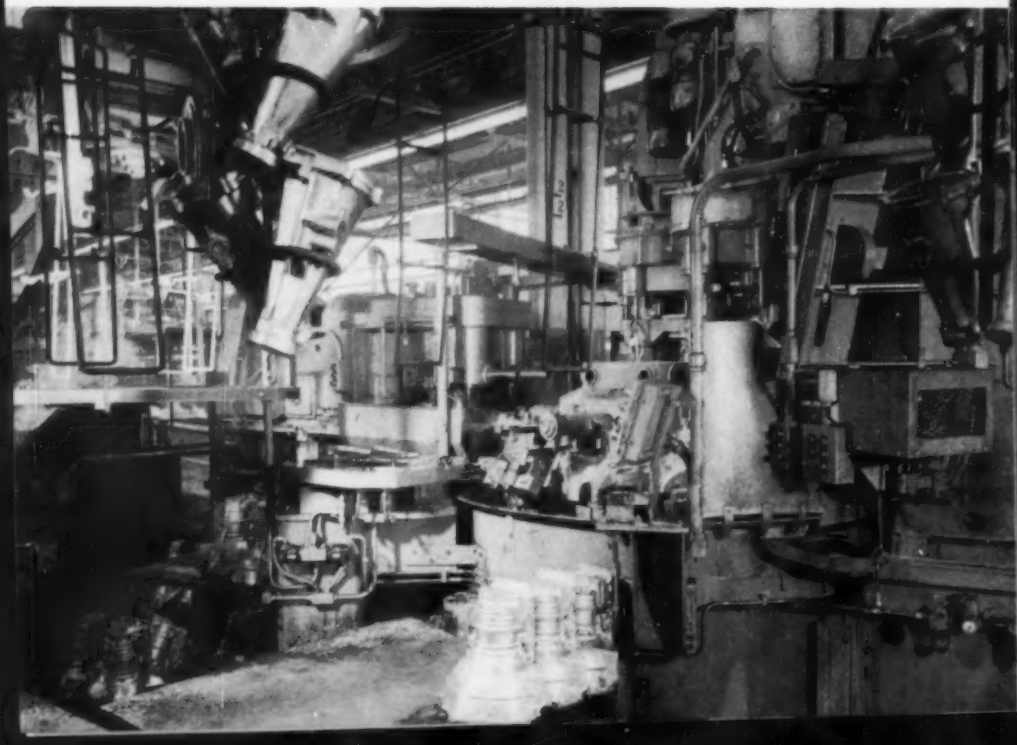
Head: Milling head with (4) manually adjustable quills.

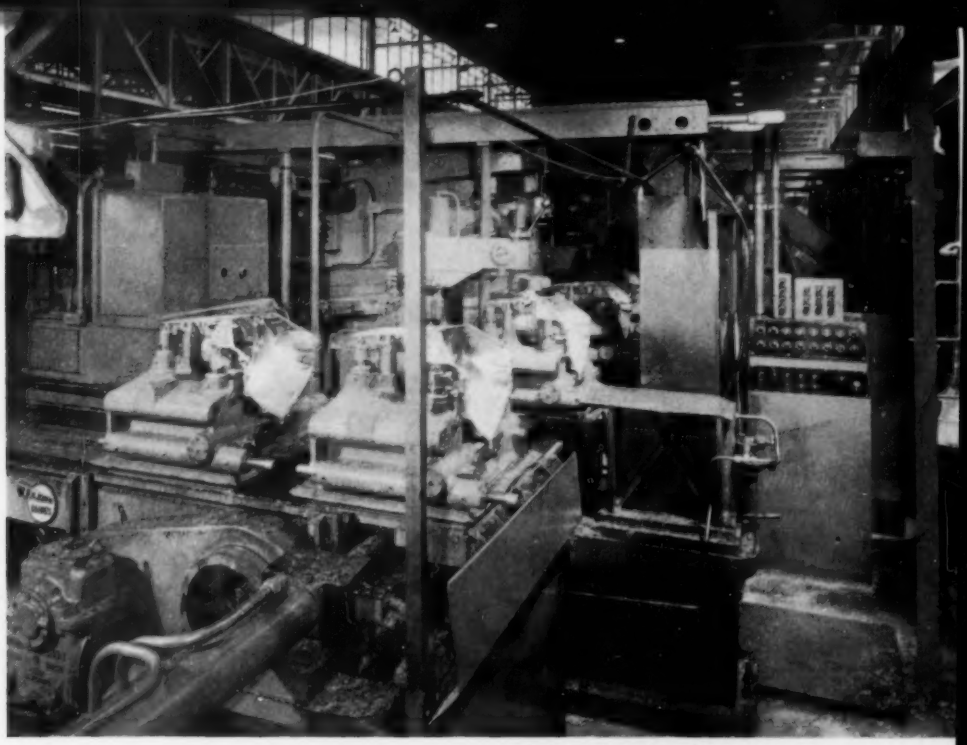
Production based on this station:

a. Cutting speed—330′ 4.0 312 rpm

The Beginning of the Line

This is the 5-station rotary table indexing machine where the piece part is readied for the line. All locating points on the piece part are produced at this first machine.





UNLOAD AND LOAD STATION of machine.

b. Feed per rev.–.048 –(.006/tooth)
c. Feed in in. per min: 15
d. Quick traverse forward–26–¾ @ 230
e. First feed–2⅝ @ 15
f. Quick traverse return–29 @ 310

Sta. 3, Unit 21: Drill (4) holes through milled pads. (S.C. hyd. unit mounted on 12-in. ways. 5 h.p.)
Head: 4-spindle, multiple.

Sta. 4, Unit 22: Spotface 4° pad and chamfer (4) holes for reaming at Sta. 5. (S.C. hyd. units mounted on 12-in. ways, 7½ h.p.)
Head: One with (4) parallel spdls. and (1) ang. spdl.

Sta. 5. Unit 23: Ream (4) ½-in. holes. (S.C. hyd. mounted on 12-in. ways. 5 h.p.)
Head: 4-spdl. multiple.

Sta. 5, Unit 24: Drill (1) ¼ dia. (S.C. quill-type drill unit arranged for a head. 1 h.p.)
Head: Single spdl.
From the rotary machine the transmission case is inspected before going to Sta. 1 for loading.

41 Station Transfer Machine

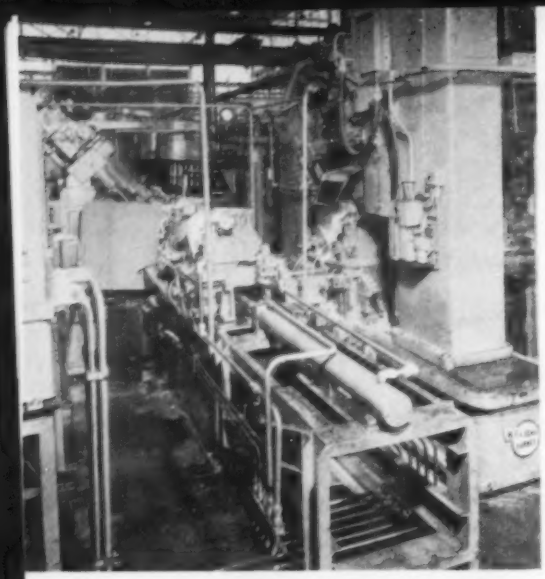
Sta. 1: Load, Clamp and Unload.

Sta. 1A, Unit 34-B: (5° below horiz.) Rough Mill 5° Face.

Sta. 1A, Unit 34-B: Saddle type units, mounted on 16-in. widths, with flow mounted feed units.
Head: Milling head with one retractable quill.

Sta. 2, Unit 20 (horiz.): Rough Face.

Sta. 2, Unit 20: Saddle type, mounted on 16-in. widths, flow mounted feed units, 7½ h.p.



STATION 14 where the machine changes direction of transfer.

Sta. 2, Unit 21: (41° 27′ from horiz.): Angular Mill.

Sta. 2, Unit 21: Same as Unit 20 (Extra pump for retracting quills)
Head: Milling head with (2) hyd. retractable quills.

Sta. 3, Unit 22 (5° back from vert.): Finish mill 5° face. This surface must have oil tight finish and be free from scratches.
Unit 22: Same as Unit 20 (15 h.p.) (Extra pump for retracting quills)
Head: Milling head with (1) retractable quill.

Sta. 3, Unit 23 (horiz.): Rough planetary mill.
Unit 23: Saddle type, mounted on 24-in. widths, with floor mounted hyd. feed units (5 h.p.)
Head: Planetary milling head with (1) spindle.

Sta. 4, Unit 24 (5° back from vert.): Drill (14) Holes for 5/16-18 top; Drill (1) Hole for 7/16-20 top; Drill (1) 7/16 Hole. Unit 24: S.C. units mounted on 12-in. widths (10 h.p.)
Head: 16 spdl. multiple head.
Unit 25: Rough Face and Chamfer

Advanced Mechanization

continued

Unit 25: Same as Unit 20 (7½ h.p.)
Head: Head with one stub spdl. arranged for hyd. feed-out operation. Production of machine is based on this unit:

a. Cutting speed: 1000′ 8″ dia. 478 rpm.
b. Feed per rev.: .0085
c. Forward travel: 18.0″ @ 250″ per min.
d. First feed out: .750″ @ 4.0″ per min.
e. Second feed return: .750″ @ 100″ per min.
f. Return travel: 18.0″ @ 350″ per min.

Production at 75% efficiency 100

Sta. 5, Unit 26 (5° from vert.): Chamfer (14) holes for 5/16 top; drill (1) hole ½-in. dia.
Unit 26: Same as Unit 24 (10 h.p.)
Head: 17-spdl. multiple head.

Sta. 5, Unit 27 (Horiz.): Drill (7) holes .428; drill (2) for .621 dia; drill (5) for 5/16-18 top; (2) ⅜-16.
Unit 27: Same as Unit 24 (15 h.p.)
Head: 16-spdl. multiple head.

Sta. 6, Unit 28 (5° from vert.): Drill (1)for 5/16-18 top; drill (2) for ¼-20 top; Drill (1) 33/64, (1) ½, (1) 11/32 holes; chamfer (1) for ¼-20 top.
Unit 28: S.C. hyd. units, mounted on 8½″ width (5 h.p.)
Head: 7 spdl. multiple head.

Sta. 6, Unit 29 (horiz.): Chamfer (2) .621 hole; chamfer (4) for 5/16-18 top; (2) ⅜-16.
Unit 29: Same as Unit 24 (7½ h.p.)
Head: 9 spdl. multiple head.

Sta. 7, Unit 30 (horiz.): Drill (4) for 5/16-18 top.
Unit 30: Same as Unit 28 (5 h.p.)
Head: 4 spdl. multiple head.

Sta. 7, Unit 32 (5° back from vert.): Chamfer (2) for ¼-20 top.
Unit 32: S.C. hyd. quill type drillunits (1 h.p.)
Head: 2-spdl. multiple head.

Sta. 7, Unit 31 (horiz.): Drill (5) ¼"; chamfer (1) for 5/16-18 top.
Unit 31: Same as Unit 28 (5 h.p.)
Head: 6 spdl. multiple head.

Sta. 8, Unit 34 (horiz.): Chamfer for 5/16-18 top; Drill (1) for .375/.376 ream.
Unit 34: Same as 28 (5 h.p.)
Head: 5 spdl. multiple head.

Sta. 8, Unit 33 (5° back from vertical): Drill (1) for 5/16-18 top.
Unit 33: Same as Unit 32 (1 h.p.)

Sta. 8, Unit 35 (horiz.): Drill (2) ¼" holes.
Unit 35: Same as Unit 28 (3 h.p.)
Head: 2-spdl. multiple head.

Sta. 9, Unit 37 (horiz.): Drill (5) for ⅜-16 top.
Unit 37: Same as Unit 28.
Head: 5-spdl. multiple head.

Sta. 9, Unit 36 (5° back from vert.): Chamfer (1) for 5/16-18 top.
Unit 36: S.C. hyd. quill type drillunits.

Sta. 9, Unit 38 (horiz.): Rough bore (1 each) 8.060-6.800, 6.280-6.140, and 5.64 dia.
Unit 38: Same as Unit 20 (2 h.p.)
Head: Boring head with (1) stub spdl.

Sta. 9A: (Idle)

Sta. 10, Unit 20A (horiz.): Chamfer (5) for ⅜-16 top.
Unit 20A: Same as Unit 28 (5 h.p.)
Head: 5-spdl. multiple head.

Sta. 10, Unit 39 (5° back from vert.): Chamfer for 5/16-18 top.
Unit 39: Same as Unit 32 (1 h.p.)

Sta. 10, Unit 21A (horiz.): Cut (1) .15 in. wide groove 6.40/6.41 dia. and finish face 8.060, 6.140, 5.640 and 1.90 boss.
Unit 21A: Same as Unit 20 (7½ h.p.) Has extra holding pump.
Head: Arr. with single stub spdl. for feed-out operation.

Sta. 11, Unit 22A (5° back from vert.): Tap (1) 7/16-20, (2) 5/16-18, (3) ¼-20 top.
Unit 22A (horiz.): Top (4) 5/16-18.
Unit 22A: Tap drive heads mounted on steel bars with power traverse (5 h.p.)
Head: 2-way individual lead screw top head with (4) horiz. spdls. and (6) spdls. at a 5° angle.

Sta. 11, Unit 23A (41° 27′ from vert.): Drill (2) for 5/16-18
Unit 23A: Same as Unit 28 (3 h.p.)
Head 2-spdl. multiple head.

Sta. 12, Unit 24A (5° back from vert.): Top (14) 5/16-18
Unit 24A: Same as Unit 22A (15 h.p.)
Head: 2-way individual lead screw top head with (5) horiz. spdls. and (14) at 5°

Sta. 12, Unit 25A (41°27′ above horiz.): Chamfer (2) for 5/16-18 top.
Unit 25A: Same as Unit 28 (3 h.p.)
Head: 2-spdl. multiple head.

Sta. 13: Idle

Sta. 13, Unit 26A: Top (5) 5/16-18; Top (2) ⅜-16.
Unit 26A: Same as 22A (7½ h.p.)
Head: 2-way individual lead screw top head with (7) horiz. spdls. and (2) spdls. at 41° 27′.

Sta. 14, Idle. Change direction of transfer.

Sta. 14, Idle.

Sta. 15, Unit 27A: (45° above horiz.): Drill (2) holes for 7/16-14 top.
Unit 27A: Same as Unit 32 (1½ h.p.)
Head: 2-spdl. multiple head.
Unit 28A (Vert.): Mill (1) oil cooler pad.
Unit 28A: Same as Unit 24 (7½ h.p.)
Head: Milling head with one manually adjustable quill.

Sta. 15A: Idle.

Sta. 15A: Idle.

Sta. 16, Unit 29A (45° above horiz.): Chamfer (2) 7/16-14 top.
Unit 29A: Same as Unit 32 (1 h.p.)

Sta. 16, Unit 30A (45° above horiz.): Drill (2) 7/16-14 top.

continued

Unit 30A: Same as Unit 32 (1½ h.p.)
Head: 2-spdl. multiple head.

Sta. 16, Unit 31A (horiz.): Drill (2) for ⅜-16 top.
Unit 31A: Same as Unit 32 (1½ h.p.)
Head: 3-spdl. multiple head.

Sta. 17, Unit 32A (Horiz.): Drill (1) for ½ P.T.; drill (1) for .621/.622 dia.
Unit 32A: Same as Unit 28 (3 h.p.)
Head: 2-spdl. multiple head.

Sta. 17, Unit 33A (45° above horiz.): Chamfer (2) for 7/16-14 top.
Unit 33A: Same as Unit 32 (1 h.p.)
Head: 2-spdl. multiple head.

Sta. 17, Unit 34A (Horiz.): Chamfer (3) for 5/16-18 top.
Unit 34A: Same as Unit 32 (1½ h.p.)

Sta. 18, Unit 35A (Horiz.): Spotface (1) boss
Unit 35A: Same as Unit 28 (3 h.p.)
Head: Single spdl. head.

Sta. 18, Unit 36A (Horiz.): Drill (1) ¼ dia. hole.
Unit 36A: Same as Unit 32 (1 h.p.)
Head: Single spdl. head.

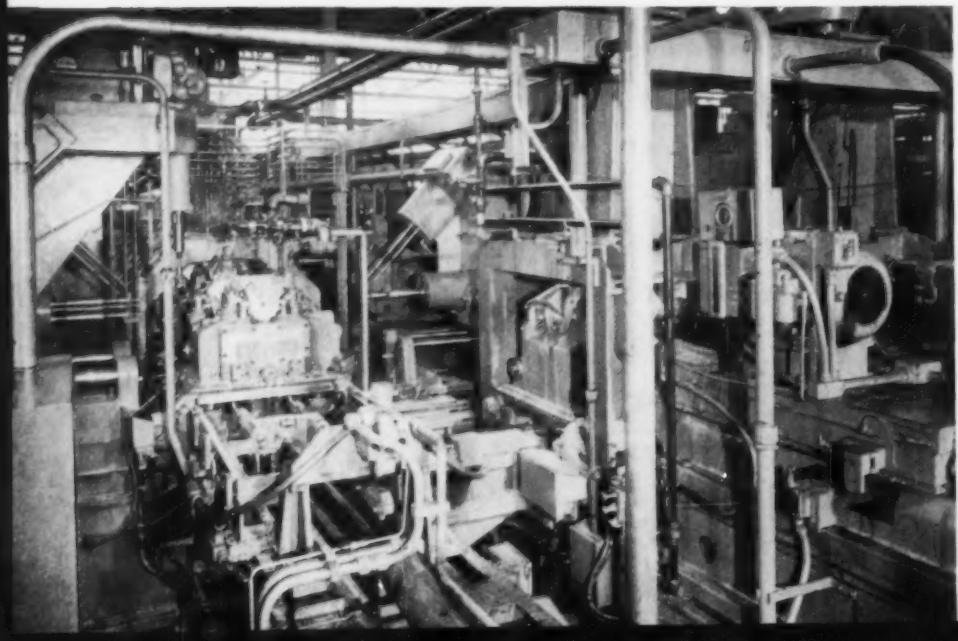
Sta. 19, Unit 37A (Horiz.): Ream (1) .621/.622 dia.
Unit 37A: Same as Unit 28 (3 h.p.)
Head: Single spdl. head.

Sta. 19, Unit 38A (5° from vertical): Drill (1) 11/32, (2) ¼; (1) 7/16 hole.
Unit 38A: Same as Unit 28 (5 h.p.)
Head: 4-spdl. head.

Sta. 20, Unit 39A: Chamfer (1) .621/.622 dia.
Unit 39A: Same as Unit 28 (3 h.p.)
Head: Single spdl. head.

Sta. 21, Unit 20B (45° above horiz.): Top (2) 7/16-14.
(Horiz.): Pipe top (1) ⅛.

AT STATION 22. Here direction of transfer is once more changed.



Unit 20B: Same as Unit 22A (3 h.p.)
Head: 2-way individual lead screw top head with (1) horiz. spdl. and (2) spdls. at 45° angle.

Sta. 21, Unit 21B (Horiz.): Top (3) 5/16-18
(45° above horiz.): Top (2) 7/16-14
(5° vert.): Top (1) 5/16-18
Unit 21B: Same as Unit 22A (5 h.p.)
Head: 3-way individual screw top head with (3) spdls. horiz., (2) spdls. 45° and (1) spdl. 5° from the vert.

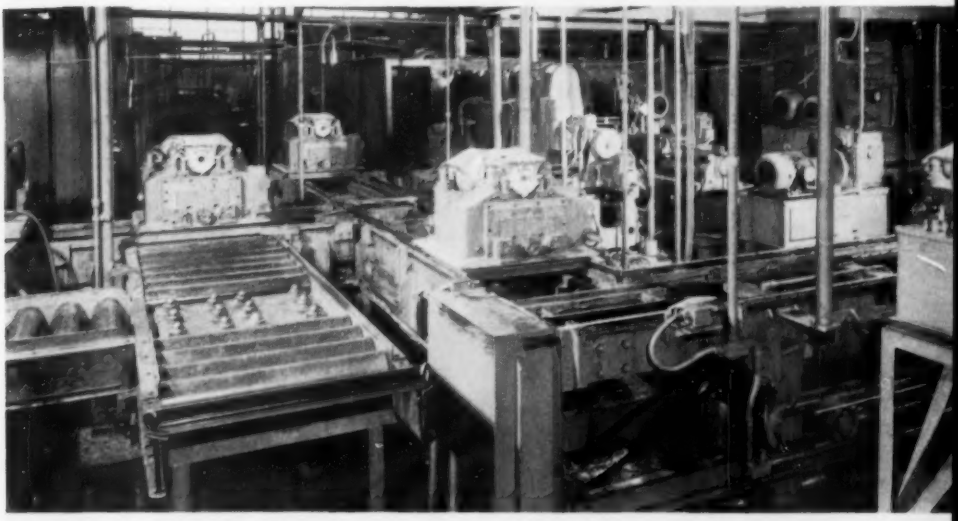
Head: 2-spdl. multiple head (5 h.p.)

Sta. 24, Idle.

Sta. 24, Unit 24B (Horiz.): Drill (1) .30, Ream (1) .375/.376.
Unit 24B: Same as Unit 32 (1 h.p.)

Sta. 24, Unit 25B (5° from vert.): Drill (2) ¼-in.
Unit 25B: Same as Unit 32 (1 h.p.)
Head: 2-spdl. multiple head.

Sta. 25, Hydraulic traversed plush unit to check (10) holes for broken tops and check (12) holes for broken tops.



AT STATION 27. Total production is divided in half and routed through the two finishing sections.

Sta. 22: Idle. Change direction of index.

Sta. 22, Idle.

Sta. 23, Unit 22B (horiz.): Rough bore 1.3120/1.313 dia.
Unit 22B: Saddle-type units mounted on 12-in. ways, and floor mounted hyd. units (2 h.p.).
Head: Single precision spdl.

Sta. 23, Unit 23B (5° from vert.): Drill (1) ¼-in., (1) ½-in. dia.
Unit 23B: Same as Unit 32.

Sta. 26, Here fixture platens can be manually rolled along a ride conveyor if part contains broken tops. Extra platens can be inserted at this station.

Sta. 27, This is an idle station from which the transfer platens will be indexed in alternate directions in order to feed (2) separate finishing lines.

Sta. 28, Unit 26B (Horiz): Finish face.
Unit 26B: Same as Unit 20. Has one

continued

extra holding pump (7½ h.p.)
Head: Single spdl. head arranged for feed-out operation.

Sta. 28, Unit 27B (Horiz): Finish planetary milling large end of part.
Unit 27B: Same as Unit 23.
Head: Planetary milling head with one spdl. (5 h.p.).

Sta. 29, Unit 28B (Horiz.): Finish bore (1) 1.3120/1.3130 and chamfer
Unit 28B: Same as Unit 22B (3 h.p.)
Head: Single precision spdl. with belt drive.

Sta. 29, Unit 29B (Horiz.): Finish bore 8.059/8.061, 6.8000/6.8015, 6.2800/6.2815, 5.659/5.663 holes. Finish bore (2) .6211/.62221 holes.

Sta. 29, Unit 29B: Same as Unit 20. Has hyd. circuit to include a holding pump (7½ h.p.)
Head: One stub boring spdl. and (2) precision spdls.

Sta. 30, Idle.

Sta. 31, Idle.

Sta. 32, Units 30B and 31B: Same as Station 28, and Units 26B and 27B.

Sta. 33, Units 33B and 32B: Same as Station 29, and Units 28B and 29B.

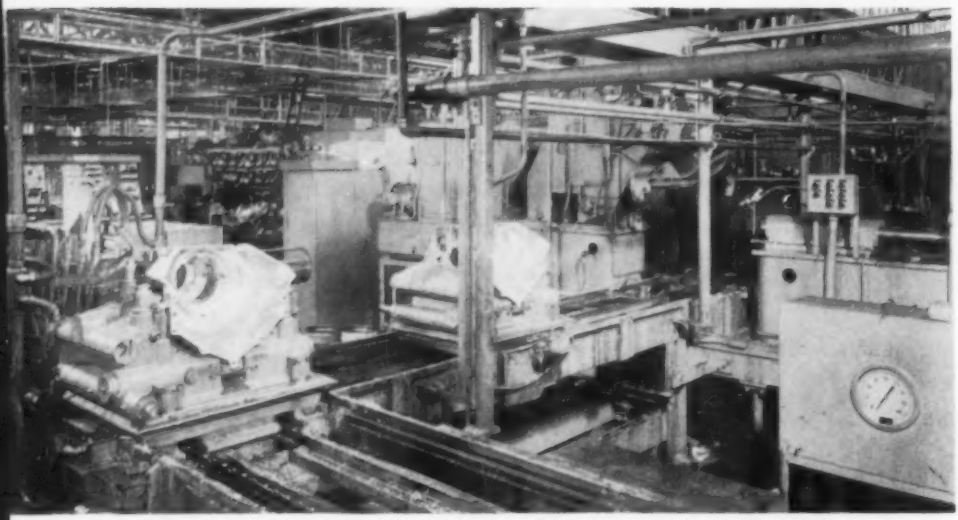
Sta. 34, Pressure test unit.

Sta. 35, Loading and unloading assembly.

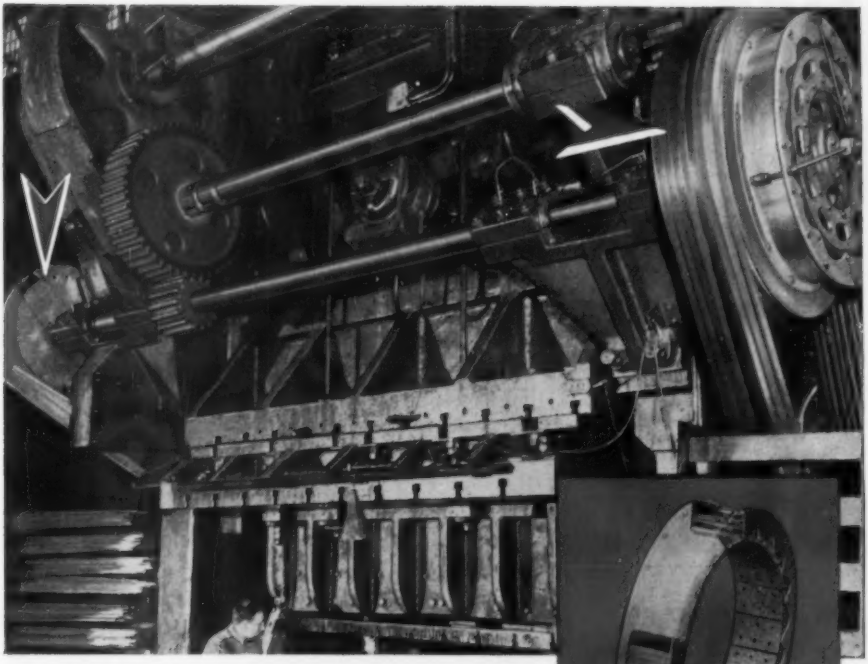
Sta. 36, Flush transfer plates.

Sta. 37, Change direction of transfer.

• • •



AT STATION 35 the part is unclamped and the direction of transfer is changed to return to the unload and load station.



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CASE NO. 2

Reliance Electric & Engineering Company

Ashtabula, Ohio

Building Parts for Stock

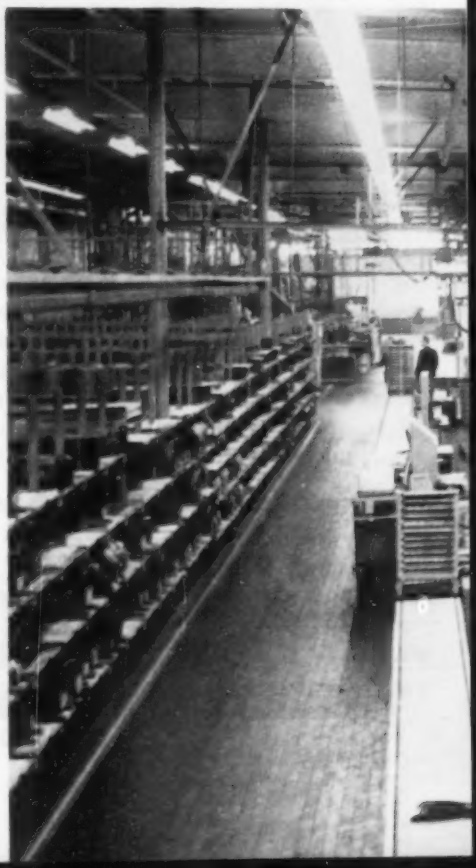
• The new plant addition to the Ashtabula, Ohio Division of the Reliance Electric and Engineering Company is an automated plant which produces motors from 1 to 40 horsepower.

The plant was designed around the philosophy of building parts for stock rather than specific order and then assembling the parts to meet customer requirements. Thus, in keeping with an increased awareness of market forecasts, financial forecasts, and competitive elements, the greatest possible flexibility has been built into the plant while including modern techniques of automatic production.

Materials Handling

In an automated factory the physical handling of the product can become a costly headache. Reliance has solved this problem with

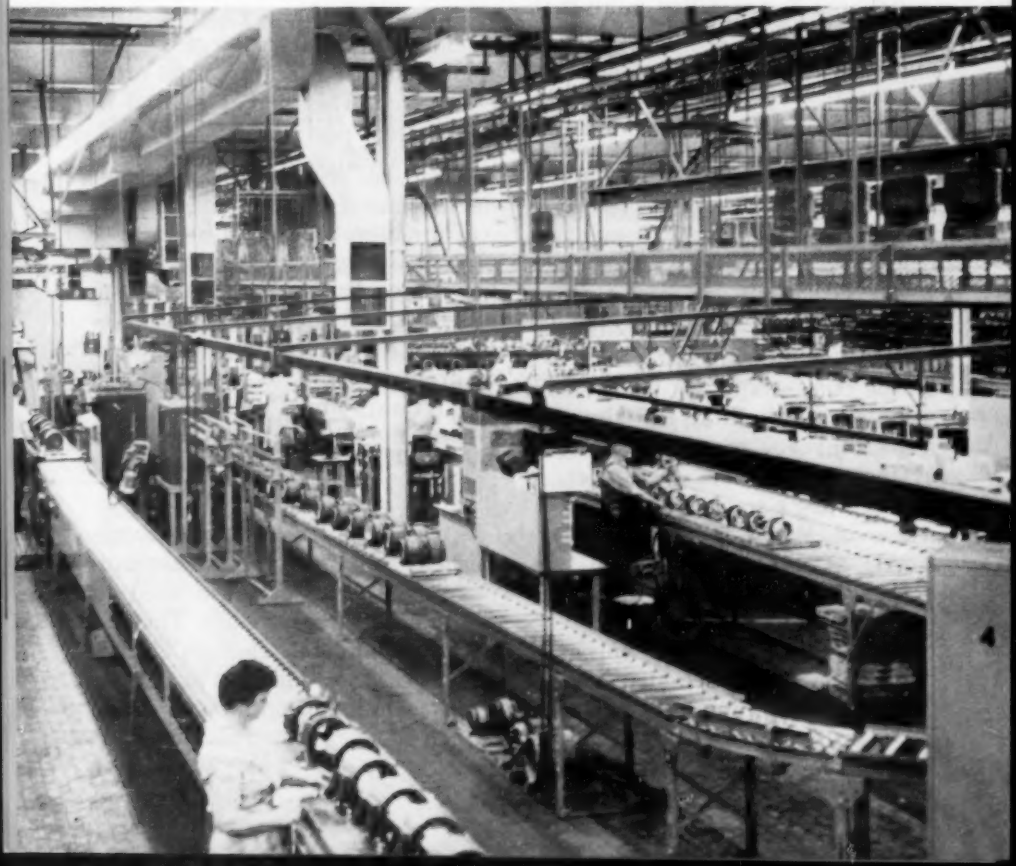
Roller and conveyor system of the finishing



Reliance Electric & Engineering Co. has great flexibility built into new automated plant where practice is to assemble parts to meet customer requirements

- - Not Specific Orders

department reflects company philosophy of completely automatic material conveyance once part leaves stock.



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modern materials handling methods.

The aim at Ashtabula is to keep components moving, with little intermediate storage. Because of length-of-run requirements, components produced by metalworking are directed to assembly storage. However, once a casting has started through the machining department it does not stop until all work on it is finished and the part is ready for assembly.

Reliance has installed more than 2060 feet of overhead monorail conveyors. Each of the conveyors is powered by a Reeves Variable-Speed Drive to match conveyor speeds to plant operation. In addition to the monorails, there is over 376 feet of roller conveyor, much of which is also powered.

To meet specialized needs, Reliance has designed some unusual equipment, like the automatic unloader for the annealing furnace. Stator cores come out of the furnace on pallets and roll down a short conveyor to a cart. As soon as the cart receives the pallet, it moves along a track toward a roller conveyor. When the cart is in position, at the conveyor, an air-actuated arm pushes the pallet off the cart, onto the conveyor. The cart then returns to the furnace.

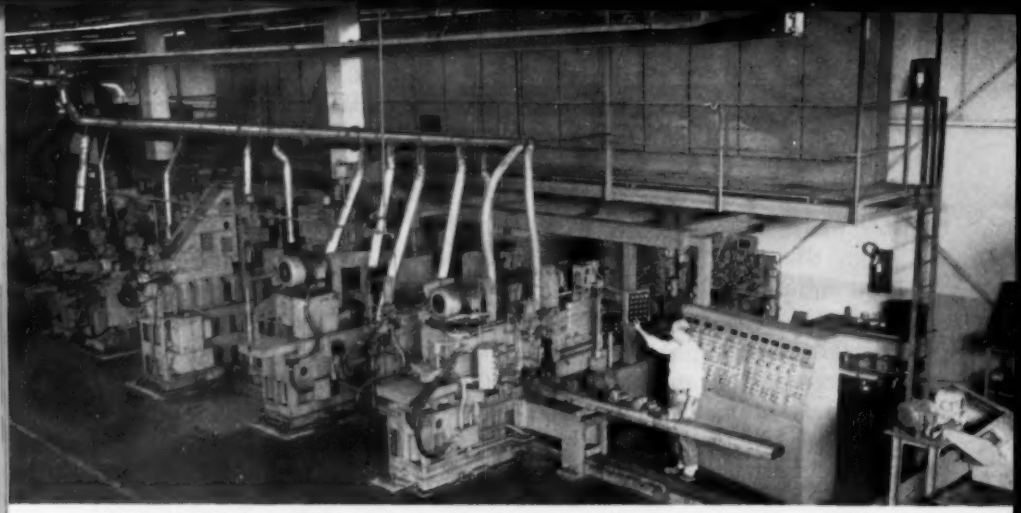
Even in the assembly, inspection and shipping departments, motors are constantly moving. At the end of the assembly section, motors roll into the test department. Each motor is hooked-up as it moves into the area and is run-in as it moves down the conveyor to final inspection.

Transfer Machine

The transfer machine at the new plant produces only motor frames, but it machines a wide variety: three basic frame diameters, each with two lengths, vertical or foot-mounted, and with protected-open, totally-enclosed, or explosion-proof enclosures. This makes a total of 36 different part numbers, each requiring a different, machining set-up.

The time required for set-up varies. Changing the same diameter frame from one length to another takes about an hour. Changeover from one enclosure to another or from vertical to foot-mounted also requires about one hour, while a complete change from one diameter to another consumes nine hours.

Speedy changeovers are accomplished by using special accessories. Colored spacers are used to position limit-switch dogs. The set-up man completely changes all tool positioning by removing or adding a spacer to every position. A check



STATION TRANSFER MACHINE does the work of fifteen machine tools, and will turn out as many as 70 completely machined motor frames per hour.

list is used to show the correct spacer positioning.

Each station on the machine has a pendant control for independent operation. Tooling is changed and tried, one section at a time. When all stations have been changed, one frame is sent through and is completely inspected. The set-up man then goes back and makes final inspection and adjustments. Complete frame changeovers are made in this manner in the shortest possible time and with the least amount of spoilage.

By properly cascading frame types and sizes, as few as 40 frames per lot can be economically handled on the transfer machine.

The machine has nine operating stations, a load station, an unload station and a turnover station. It faces, bores, mills, drills, and taps motor frames. A rough casting goes into the transfer machine and comes out the other end ready for use, except for a rabbeting operation which is performed manually.

There are 20 a-c. motors on the machine, and 13 additional a-c. motors are used on the hydraulic actuating mechanism. The machine uses a separate work holder at each station. A hydraulically-operated shuttle transfers the castings from station to station. A V°S Drive is used for the feed drive on the milling machine section.

The transfer machine will handle 36 different motor frame castings. Production will vary from 70 frames to 42 frames per hour, at 100% efficiency depending on the frame size.

This one machine does the work of a milling machine, 11 vertical turret lathes, a multiple spindle drill and a five-spindle drill. The

continued

transfer machine itself costs 25% less than the total price of this standard equipment.

With in-line operation, and units placed close together, the transfer machine requires a minimum of space. Conventional equipment for the same job would probably consume four times as much floor area.

Manpower savings are significant also. It requires only three men to completely machine frame castings. A full line of standard machine tools would require 15 operators as well as set-up men.

Probably one of the most important features of the transfer machine is accuracy. Everything is machine-controlled. Part positioning, depth of cut, feed rates, etc., are all pre-set and automatically handled by the machine.

Quality Control

In any high-volume production plant, product quality can become a critical problem. The manpower required for 100%, or even 50%, inspection could shoot overhead costs to intolerable heights.

To meet the challenge of maintaining product quality, Ashtabula production men have devised a system that is economical and provides specified quality on all motors shipped.

The basis for this quality lies in machine control of the operations. Wherever possible, machining judgment has been removed from the hands of the operator. The huge transfer machine operates to close tolerance standards, automatically. Separate tests have been run on every transfer machine operation to determine exact tool life. The operator is signaled when the end of tool life is approaching, and the machine automatically shuts down when the tool must be changed.

Wherever possible, the standard machine tools have attachments to control quality automatically. The feed rate and depth of cut on the shaft grinders, for example, are automatically controlled. A double-contact electric sizing gauge takes a constant reading on shaft diameter during the grinding operation. Just before the finished diameter is reached, the feed rate is automatically reduced. When the gauge reaches the exact setting, the grinding operation stops.

Overlaying this basic, built-in control, is a plant-wide quality control system. Each operator has a quality control board at his station. An inspection of the operator's work is made regularly. These inspections range from 2 pieces per hour to 8 pieces per hour, depending upon the type of work, the machine, and the operator.

The findings of the inspector are charted on the operator's quality control board. The tolerance limits are indicated by two red lines on the chart. Inside these lines are two gold warning lines. By looking at the chart, the operator can check his work and maintain an even quality trend.

On top of each board is a red light. If the operator loses complete control of his quality and goes outside the tolerance lines, the light goes on. This immediately brings the foreman to help the operator regain control. The light also serves as a signal for increased frequency of inspection.

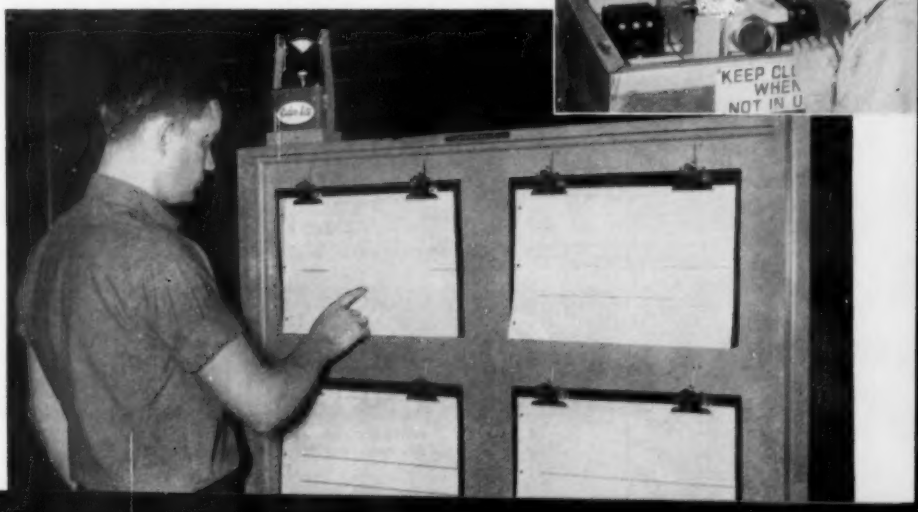
In some instances, 100% inspection is necessary. All shafts are checked for straightness in assembly. Bearing seats are also checked for run-out. Rotors are checked for clearances. Stators are surge-tested for electrical characteristics. Each motor is run for at least 12 minutes. Finally, the completed motor is carefully checked out electrically.

As a final check on the quality control system, the entire stock of finished parts is inspected twice a year. The results of those inspections have correlated exactly with the results of the running quality control.

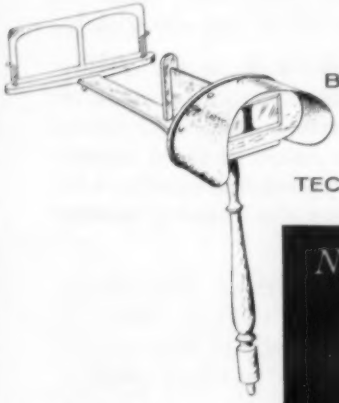
By utilizing these overlapping quality control systems, Reliance successfully combines full volume production with specified product quality. • • •

RIGHT—An inspector checks a lamination from the notching press on this optical inspecting device.

Operators constantly check the accuracy of their work on the quality control boards. The heavy lines indicate tolerance limits. If the operator loses control of accuracy on his machine, the lamp on the top of the board is lighted.



Great in its day...



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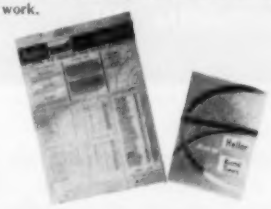

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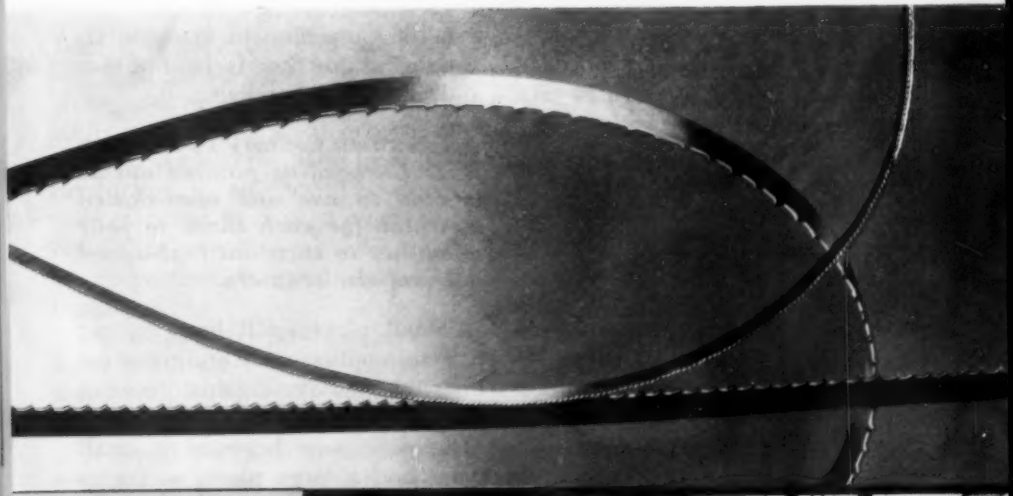

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CASE NO. 3

Twentieth Century Manufacturing Co. Libertyville, Ill.

How a Small

By **Darrell Ward**
Field Editor

• How far can advanced mechanization go in the small plant? Can it be made flexible enough to take care of frequent part changeovers?

The experience of 20th Century Mfg. Co., a 23-employee, 14,000 square-foot plant manufacturing reamers in Libertyville, Ill., throws some light on these questions.

Here we saw some of the most ingenious tooling and examples of advanced mechanization we've seen anywhere: automatic infeed attachment for a Cincinnati No. 2 centerless grinder; an automatic compensating chuck; conversion of a standard engine lathe to automatic turning of shafts; rebuilding a milling machine to machine six reamers at one time instead of one, and other applications.

Twentieth Century's President, R. L. Garberding pointed out he is able to use one semi-skilled operator for each three to four machines to turn out high-speed decimal size reamers.

"Small plants will have to get into automation more and more for their own survival against growing competition," Mr. Garberding said. "The difference between a small plant and a large plant, so far as automation is concerned, is really an advantage for the small plant.

Operator Makes Mechanization Pay Off

W. L. Garberding's approach to full mechanization is strictly functional. He started with speeding up machining of raw stock to get work into the production line fast. Then he concentrated on the cutting operations. Here's a story about some unique mechanisms that have increased production, reduced rejects.

The small plant can be more flexible. The small plant, to operate efficiently, must be universal in its various operations so that a quick change over can be made from one production to another. The down time involved in change overs and repairs, or retooling, must be small in proportion to total operating time."

Of course, if Mr. Garberding finds a job shop with exactly the right equipment to consolidate a number of functions which ordinarily would be done separately in his own plant, he takes advantage of the situation. His thinking is that if he would automate everything without discretion, he would be top heavy with expensive equipment; he would no longer be a small plant operator. Sub-contracting and automation go hand-in-hand in his shop. He doesn't want to lose the benefits of one while concentrating on the other.

The more anyone moves toward automation, the more devices you put into operation, the more will be the mechanical motions you have to care for. This calls for more points of wear, more points to lubricate, more general maintenance of all kinds. It also may create new problems of waste disposal and increased power distribution.

continued

In all of the improvements at 20th Century, concentration is on the simplification of mechanisms. Instead of making more complex mechanisms, Mr. Garberding works toward reducing the number of moving parts in existing equipment. He may have to use an entirely different method of operating, or consolidate more than one operation at a time.

"The advantage to building your own equipment is that once you build something, you can easily duplicate parts for replacement," Mr. Garberding said. "Some of the complex equipment that is now being sold will have precision parts that are hard to replace by the mechanic and may be impossible to get when you need them."

But just how does quick changeover and flexibility relate to Mr. Garberding's specific operations?

20th Century produces between 60 and 80 different types of reamers and counterbores. Each will vary in length and diameter. A production run may range from 20,000 pieces down to a dozen or two. They keep an inventory of all numbers and fill immediate orders out of stock. Whenever a bin begins to run low, they tool up for that item and run a sufficient quantity to replace the stock and avoid running out. The same procedure is followed for each of the other styles and sizes.

The popularity of a specific unit is considered as well as any special orders that may come in, before production is scheduled for each set up. For instance, if it takes four to five months to run through the list of different items, each individual run must be of the right quantity of an item to last three to four months. Some items might sell in quantities of thousands per month. An unusual item may sell only a dozen. On the first item, they must make a few thousand every three to four months, while on the second item, a few dozen.

What happens if they get an unexpected order for a few thousand, or even a few hundred of the less popular item? With facilities for quick changeover they are flexible enough to take care of that kind of situation with very little trouble and practically no added cost.

One interesting application at 20th Century concerned a problem with shafts, which are produced in varying sizes, but had one thing in common: they could be single-point turning operations.

Admittedly, some of the shafts could be formed by forming tools, but due to low annual production they could not justify the purchase

FIRST PROBLEM: Speeding up bar stock machining

Inaccessibility of blanks, which dropped with shavings into waste pan inside base of machine, slowed down movement of parts to next operation. Garberding cut a hole in the side of the machine and installed a screen chute for ejecting parts, and a welded lip to return chips and cutting lubricant to pan inside.

Constant replacement of broken springs on the cam follower was eliminated by air cylinders. Considerable savings were made in costly replacement parts and in down time.

of standard automatic machine tools.

An operator worked full time to perform one operation on the turret lathe. It was decided to convert it into an automatic lathe to perform the single-point turning operations, which were also secondary operations.

The two biggest problems to be solved were the sequence timing of the machine's movements and the chucking of the piece. On the job being run during our visit the part was a short shaft about 1/4" by 6", which had been welded but required cleaning up prior to centerless grinding. Carbide insert tooling was used, and they are getting eight hours per cutting edge with Carboloy 370. Spindle speed was 820 rpm with a feed of .008 to .010 in. per rev. Another job requires .092 in. depth of cut,

which the machine apparently takes in stride. The sequence of the operations is as follows:

1. Magazine (on rear cross slide) feeds to load position.
2. Tail stock center feeds forward, picking up piece.
3. Self-compensating air chuck closes.
4. Spindle starts up, magazine returns to start position.
5. Turning tool approaches in rapid travel; fine feed starts just before hitting work.
6. Spindle clutch and brake engaged; feed slide returns.
7. Chuck opens and ejects part.
8. Machine off for a fraction of a second to ensure all electric controls are reset.

To change setups requires from 1 to 1½ hours, during which time the tailstock centers cross slide magazine feed, spindle speed and the timing unit have to be changed. The tailstock centers are made for each job and so are the carriers for the magazine; each fits its position quickly. Speeds and feeds as well as the timing unit are recorded for future setups and can be quickly reset. Turning tools must of course be adjusted for each job.

The timing sequences on the machine are controlled by a Multiflex reset timer made by the Eagle Signal Corp. This unit consists of a series of contacts each having two fingers which ride on a cam plate. During the timing interval, a synchronous motor drives the plate downward through a solenoid operated clutch. The contacts are closed and opened in the sequence that the fingers are set to drop off the edge of the cam plate. When the clutch solenoid is released to disengage the clutch, the cam plate is reset by a spring. Simultaneously, the contact fingers are lifted to their normally opened or closed reset position.

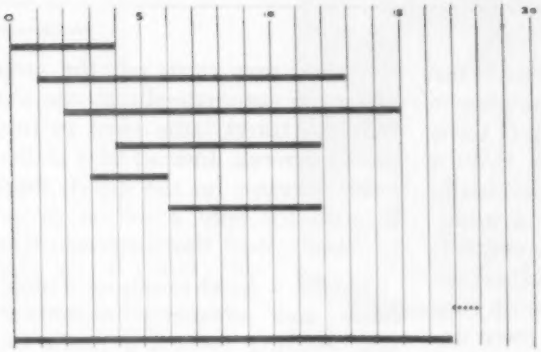
Changing over from one setup to another is no problem because the timer can be set to any sequence desired and any portion of the cycle can be adjusted at any time. It is also possible to duplicate previous setups quickly by recording settings.

The self-compensating chuck mentioned in the sequence of operations is a patented invention of Mr. Garberding's. It can be actuated either hydraulically or pneumatically, the latter being used on this application.

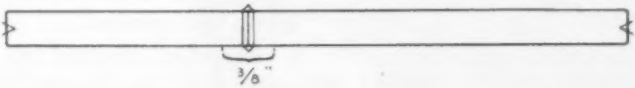
The interesting feature of the chuck is that the chuck head rotates about a dead center, cone cup or any desired locating nest. Each jaw of the chuck operates independently but does not affect concentricity due to the design of the chuck.

In operation, air or hydraulic

TABLE OF TIMING SEQUENCES (TIME IN SECONDS)

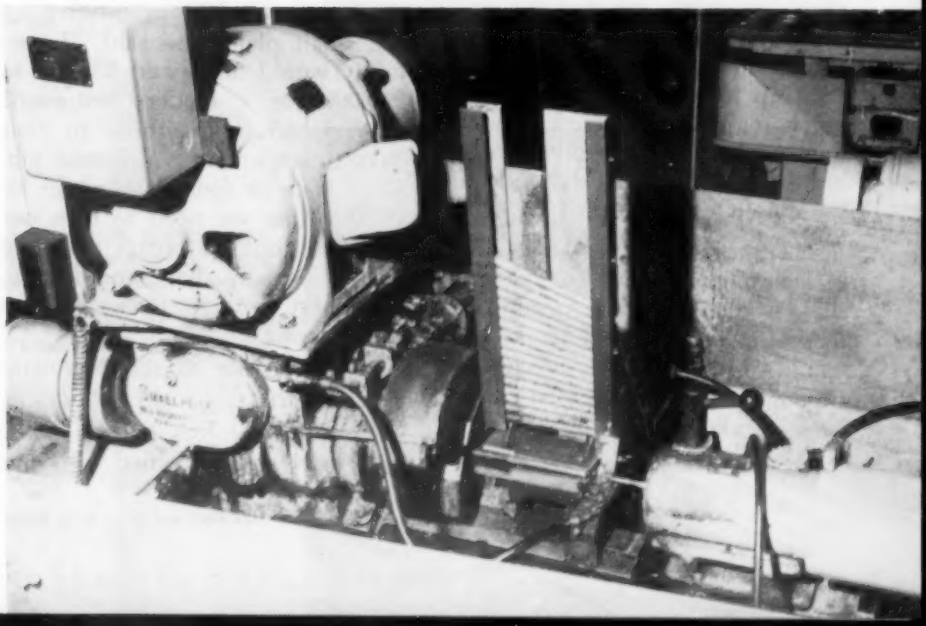


THE JOB



Automating an Old Lathe

An old lathe bed was refurbished into a fully automatic magazine fed machine. No operator is required except to load the magazine. Cradle extends blanks in line with centers. Air actuated tail stock pushes piece forward into jaws of automatic chuck while cradle returns to magazine for next piece. Screw-fed cutting tool automatically begins its cycle a fraction of a second after work is centered. Cutting continues without hesitation.



continued

pressure is introduced through the dead center to an annular groove which distributes it to each of three axial pistons. The pistons in turn drive the chuck jaws individually against the workpiece by a wedging action. As the first jaw contacts the workpiece, in case of eccentricity in the piece, it stops on contact without exerting any force until all three jaws are in position. With 40 psi air pressure on the line, clamping force exerted by the jaws is 500 pounds.

With these two important problems solved it is only a matter of installing air and hydraulic cylinders and micro-switches for the movements of the machine. The basic machine selected for modification was a Reid Bros. Smallpiece tool room lathe. A 7½ hp motor furnishes power for the hydraulic system and the spindle. The hydraulic unit supplies the feed slide with up to 325 psi. A flow control valve regulates the feed; the rate being determined by finish desired and spindle speed in relation to the timer unit.

The magazine, tailstock, chuck, and clutch and brake for the spindle are motivated by Airmite cylinders operating under 80 psi. The spindle brake is modified from a Chrysler Corp. automotive emergency brake.

Using the newly modified lathe, the plant now turns out the same operation automatically in one day that the turret lathe used to turn out in a week. Instead of a skilled lathe operator for the turret, there is need for only a person to occasionally load the magazine.

This is a good example of flexibility and advanced mechanization working toward a profit because the automatic machine can be changed from one size operation to another in about an hour to an hour and one-half.

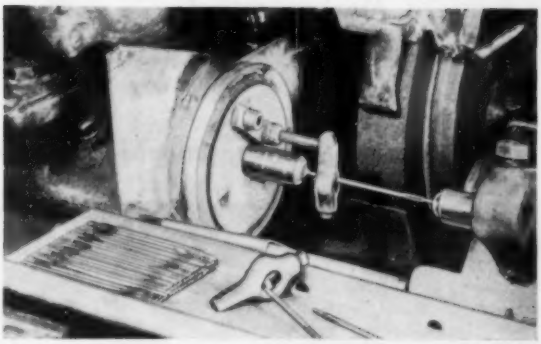
However, it would not be a good example if Mr. Garberding had not been able to redesign and retool this lathe himself.

"The cost of a commercially made machine which is universal in application with all the automatic features I incorporated in the old lathe would be prohibitive for the small plant," he said. "I certainly would not spend $35,000 to $40,000 for a modern automatic lathe which takes three to four days to set up for a different job. That three or four days might be all the time we need to turn out three or four different jobs! We don't normally have production runs large enough to warrant so much down time."

We asked Mr. Garberding why more electric motor driven devices were not used.

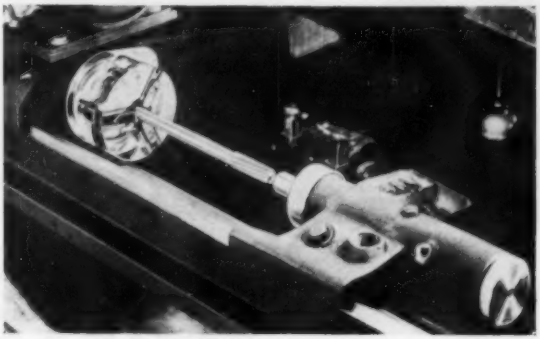
"We are not concerned with any

It started with this . . .



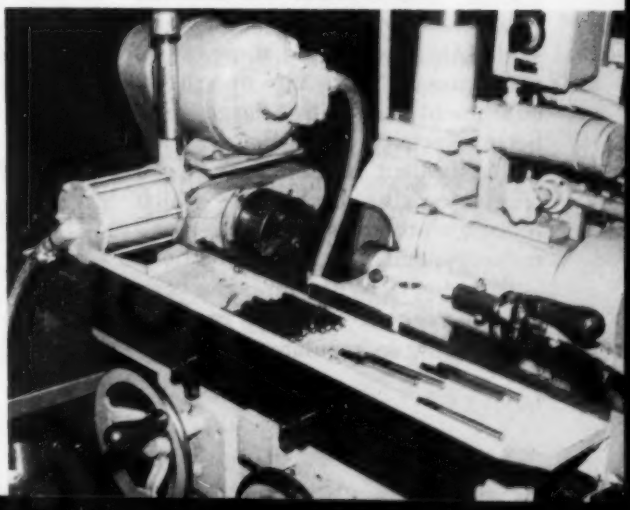
FORMER DOGGING METHOD was wasting 30% of operator's time in OD work on reamers, was marring work with dog setscrews.

. . . but with floating jaw chuck . . .



NEW CHUCK has upped production to point where one operator can now run two machines.

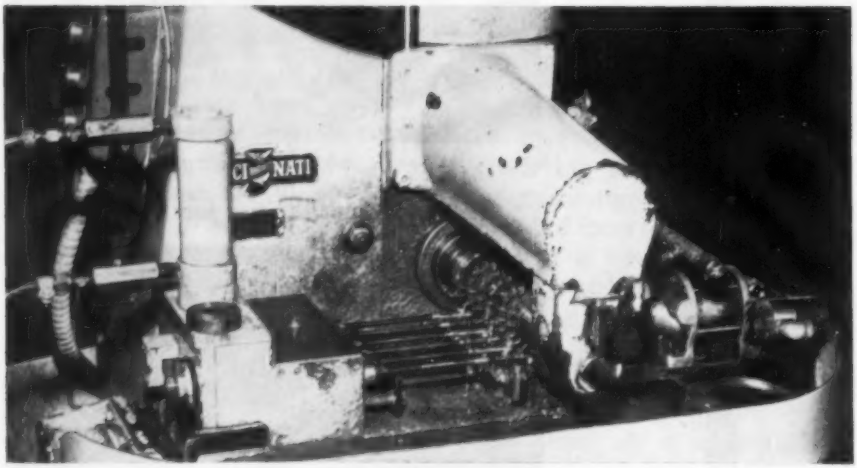
. . . machining is faster, easier



IMPROVEMENT IN GRINDING OPERATIONS. Comes with the floating jaw chucks, automatically operated by air to hold work against dead centers to eliminate eccentricity of milled pieces. Easier operation and faster handling are accomplished by using a simplified air operated tail stock in combination with the automatic chuck.

continued

Milling machine is remodelled to mill six



A small milling machine was remodelled with direct drive motor in head to permit cutting six pieces at once. Air operated indexing device at left, coupled with modified cam inside base, permits automatic cutting of six flutes before machine shuts off. This enables one operator to keep four such machines running constantly.

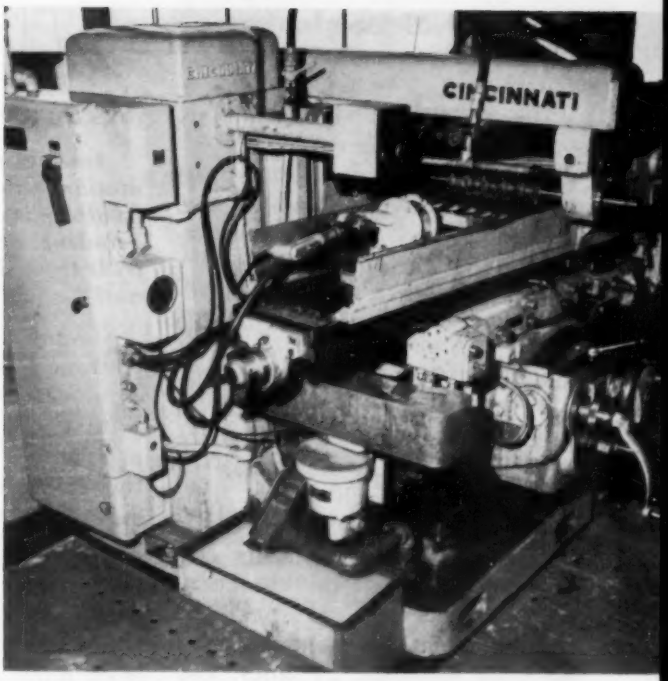
heavy or bulky pieces of work to handle and do not require the power you get from motors," he said. "Air is clean and there is less maintenance with air operated equipment than with a large number of electric motors. Besides that, air equipment is simpler. You can eliminate drive mechanisms which require clutches and brakes, speed reducers, and gear chains or belts and pulleys. With air, you can quickly regulate speed or pressure with a simple regulator."

Exhausted air is used for ejection of work pieces, for blowing out fixtures, and in some places for blowing out centers and holes bored in a work piece.

It is very obvious that this company is doing very well in keeping down the cost of mechanizing their equipment by making conversions and building new equipment themselves.

"We not only save the cost of engineering included in the price of

reamers at once



Air and hydraulic operated mechanisms controlled by micro-switches and solenoid valves enable this milling machine to perform more automatic functions. Dial at left of bed can be set for any number (up to 400) of passes for a single cycle, before machine shuts off.

new equipment, we also save a lot of time," Mr. Garberding said. "I often will design a part, have a casting made, machine it in our shop, and fit the whole new machine together in the length of time that some manufacturers take to confirm an order. One or two machines that I have rebuilt were quoted on the basis of one to two years delivery. I located standard components from used machines, consolidated them for my purposes, made a few special parts, and got the machines into full production in less than six months."

Mr. Garberding is constantly searching for ways to step up production, bring down costs and increase his workers' wages.

His first effort was to speed up the machining of raw stock to get pieces into the production line as fast as possible. After all, there's no point in speeding up a cutting or grinding operation if a mill or grinder has to stop and wait for a blank.

continued

The second step was milling. Automatic indexing equipment enabled one operator to operate three or four machines instead of one. The object was to make the machines cut all six flutes in a reamer without attention. Garberding rebuilt a milling machine to handle six reamers at one time instead of one. The operator only had to insert the blanks, six at one time, in three or four machines instead of individually setting and indexing each flute in each piece. This makes just the milling operation on one machine six times faster and six times easier on the operation. When an operator takes care of four machines at once, production has been increased 24 times. The next step at the milling machine will be magazine feeding.

The third step in profitable advanced mechanization was in the grinding operations. Automatic indexing and automatic loading were natural improvements in this department. The approach was not to add more machines and more workers to boost production, but to help a specific worker use less effort and get more out of the same machine. An improvement in any operation may increase the number of pieces per hour, or it may only improve the quality of production. The same principle applies right through the plant, from raw stock to shipping department.

Among the interesting automation equipment built by Garberding is an automatic infeed grinding attachment which controls the infeed cycle of a Cincinnati No. 2 centerless grinder.

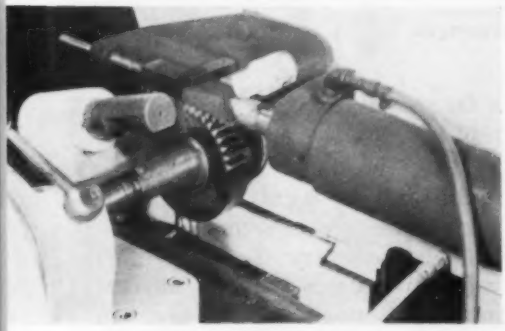
Timing for the infeed cycle is electronic, and actuation of the regulating wheelslide is pneumatic. With a cost around one-twentieth as much as a grinder, Garberding figures the unit has paid for itself in only a few months.

The part being run on the machine when we visited the plant was a small-diameter pilot reamer, being brought to finish size with stock removal of .003 to .005-inch, and being held to limits of .0001-inch, typical of runs in Twentieth Century production.

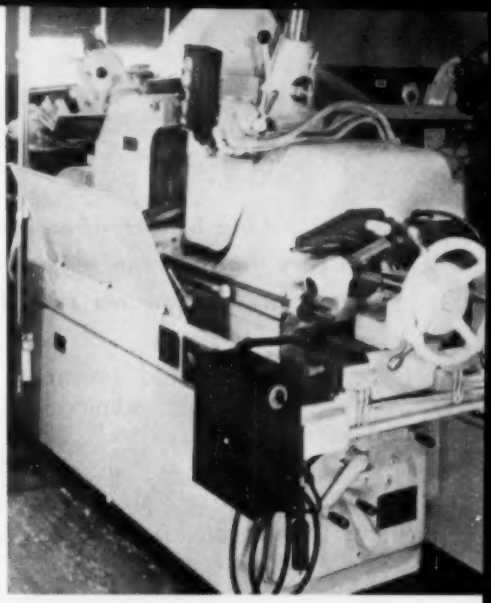
Range of stock removal available with the unit is from .005 to .040-in. in one pass, and is varied by adjusting a simple variable-position mechanical stop which limits travel of a rack driving the lead screw nut.

In operation, the operator drops the workpiece between the wheels and presses the stop button on the panel mounted near the work position. This actuates the timer, which has an automatic voltage regulator to maintain constant cycle time, controlling operation of

Can small plant grinding be automated?



PNEUMATICALLY ACTUATED RACK is against positive stop (notched bar in extreme upper left) in sparkout timing position on completion of infeed. Notches in positive stop aid in approximating stock removal adjustment during setups; unit gives stock removal range from 5 to 40 thousandths, with accuracy of .0001 inch.



AUTOMATIC INFEED ATTACHMENT on No. 2 centerless has speeded production on infeed centerless work. Control box on front houses electronic timer, solenoid valves for pneumatic cycling, and bleeder valve for control of feed rate. Controls are grouped adjacent to work position; operator starts each grind with start button.

the pneumatic cylinder. The cylinder drives the lead screw rack through the infeed stroke at a speed regulated by adjusting a bleeder valve in the air line. Stroke of the rack is then limited by the positive stop. At this point a sparkout dwell is provided for by the timer, which maintains air pressure momentarily to keep the rack against the stop. The length of dwell can be varied as required.

Total infeed stroke can be kept as low as .007-inch, a feature built into the unit because much of Twentieth Century's work is on small diameters and involves light stock removal. With such a small wheel slide travel, small workpieces can't get wedged between the regulating wheel and the workrest blade, which is a decided safety advantage. Garberding has found that setup time for the grinder has been reduced appreciably by the unit. As a safety feature, a red caution light goes on during setups, and it also glows during the grinding cycle to caution the operator against insertion of another workpiece. Among other benefits, it has been possible to increase the number of grinds per dress, possibly because feed motion is more uni-

continued

". . . a big feature of automatic equipment is uniformity. Every time you can reduce the number of rejects you gain tremendously on the law of averages."

form than with hand operation. Surface finish on the workpiece has also improved.

What are some of the maintenance problems at Mr. Garberding's plant?

Coil springs used to be the most common source of trouble, especially when compressed to one-third of normal length. This problem was eliminated with the substitution of air or hydraulic operated cylinders for cushions and return mechanisms.

For example, one screw machine used two 14-inch springs to make the turret return when the cam follower drops off of the cam. The spring was compressed about 4½ inches on the full stroke.

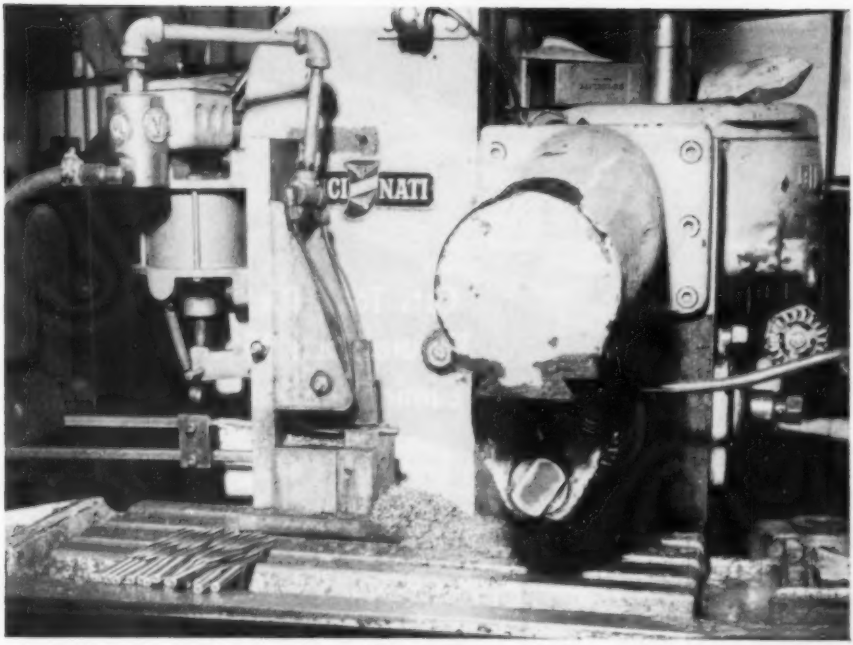
"We were replacing springs two or three times a week and were buying them by the gross at one dollar each," Mr. Garberding said.

"We spent five hours in labor and $5 on material to make a pair of 7-inch air cylinders to do the same job—only better. The air cylinders not only are adjustable by regulation of pressure to give exactly the right contact between cam and follower, but they also give a far smoother action to the turret return.

"The V-belts were also a big problem. They were always wearing out. On one machine, the V-belts broke every 60 days. They will go to pieces sooner than that in the presence of oil. I am now in the process of replacing every V-belt in the plant with the silent chain drive belt. These give positive drive with no slippage and can be operated around oil or anything else without damage."

With a change from a V-belt to a silent chain belt, pulleys must be replaced too. This runs about $15 to $20 on the average for Garberding, including belt, two pulleys, and special sleeves or bushings he might have to make for fitting some of our odd size shafts. To fit a standard size shaft, of course, the cost runs much less.

As most of this plant's automated devices are air actuated, Mr. Garberding considers clean air of prime importance. Automatic drain filters are used throughout. These keep the air clean and automatically drain off accumulations of moisture without attention from



Utilization of exhaust air helps provide more uniform quality parts without damage from chips as well as faster handling of parts. In this view, exhaust air from the air operated clamping mechanism blows through the small tubes to clean oil and chips away from work and from the V-block anvil which holds work during operation.

Utilizing Exhaust Air

the operator. The biggest problem in air equipment is to keep it lubricated and keep out moisture.

No one of these mechanisms was an end product in itself. Each was developed strictly to simplify the operation it replaced or to simplify the work performed during a certain machine operation. The overall function of each machine operation was tackled first with an attempt to increase production, reduce loss, or improve quality at that point in the flow of work.

• • •

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MACHINE AND TOOL **blue book**

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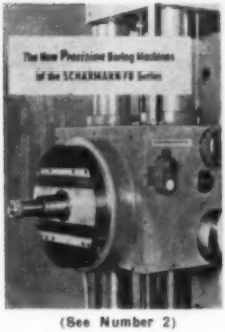

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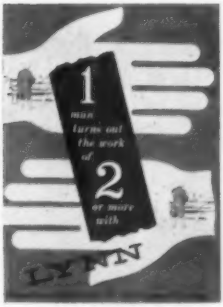


(See Number 3)

1. Floating Tool Holder. To correct misalignment of spindles, wear of spindle bearings, errors in tool shanks, tool holder really floats under all conditions of service. Folder from Wayne Tool Co., Dept. RS, Waynesboro, Pa.

2. Boring Mill. Bulletin presents FB Series milling and boring machine. Headstock is suspended by two well dimensioned solid steel columns, hardened, ground and superfinished. Scharmann Machine Corp., 337 Blvd. of the Allies, Pittsburgh 22, Pa.

3. Hydraulic Drive that converts any ram turret lathe to automatic operation is described in folder. Turns, bores, deep hole drills, faces, undercuts, forms; can tap and chase both right and left hand threads in same cycle. Lincoln Industries Co., 1123 S. 7th St., Minneapolis, Minn.

4. Universal Tapping Fixture. Can be used both for tapping of holes from 0-80 to ¼-28 or as an indicator base and mounting for precision inspection. Described in flyer from Industrial Sales Co., 1507 M St., N.W., Washington, D.C.

5. Profiling Tools incorporating Kendex "throw-away" inserts are catalogued in Bulletin B-105. Four styles of these carbide tools with 18 standard variations in dimensions are offered with insert seats and chip breaker plates. Kennametal Inc., Latrobe, Pa.

6. "No Cycle Time Out for Wheel Dressing," Bulletin LO-5709, is the first of a series of progress reports on permanent form control of grinding wheels using cutters of cemented diamond particles. Available from both Koebel Diamond Tool Co., 9456 Grinnell, Detroit, and Jones & Lamson Machine Co., Springfield, Vt.

7. Work Simplification. Brochure describes 60 films on the work simplification methods of leading industrial concerns. Films may be rented for five-day periods. Industrial Management Society, 330 S. Wells St., Chicago, Ill.

8. Hand Knobs. Flyer sheet covers aluminum hand knobs. Condensed tracing template shows all sizes in full scale. Northwestern Tool & Engineering Co., 118 Hollier Ave., Dayton 3, Ohio.

To receive copies of literature described on these pages, simply encircle corresponding numbers on handy postage-free Action Cards opposite page 64 and elsewhere in this issue.

Free Literature

continued

9. Adjustable Bed Presses. Bulletin 60E supplement presents Series D adjustable bed presses redesigned and equipped for secondary operations between automated presses in production line. Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N.Y.

10. V-Drive Catalog is a convenient source of information on fractional hp V-drives, drive parts, accessories. Maurey Mfg. Corp., 2915 S. Wabash Ave., Chicago 16, Ill.

11. Broaching Tools. "How to Care for Broaching Tools" gives helpful tips that will allow broaching operations to continue without interruptions caused by non-availability of broaching tools due to careless handling. Lapointe Machine Tool Co., Hudson, Mass.

12. Reamers. Comparative net price selector features an interesting arrangement of reamers by decimal equivalents from .0400 to 3.0000 inches. Lavallee & Ide, Inc., Chicopee, Mass.

13. "You and The Raymond Corporation" is written in several sections, each addressed to a particular group: employees, sales representatives, investors, suppliers, neighbors, and members of the material handling industry. Raymond Corporation, Greene, N.Y.

14. Assembly Machines. Brochure describes and illustrates a variety of interesting special automatic assembly machines designed and built by Omer E. Robbins Co., 24800 Plymouth Rd., Detroit 39, Mich.

15. Diamond Tools. Catalog 4-57 lists throw-away type dressers; they do not require resetting. Steel matrix holds small, elongated diamonds until they are completely used. Precision Diamond Tool Co., Box 274, Elgin, Ill.

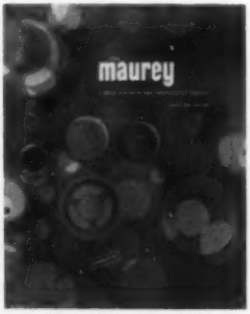
16. Plug Gage Data Chart. Select-Aire chart, complete with listing of all popular gaging plug types, sizes and specifications, is a time-saver in selecting and ordering Air-O-Limit plugs. Pratt & Whitney Co., Inc., West Hartford, Conn.

17. Collets. Featured in Catalog 22 are standard collets and feeders, Quick Change master collet, Style L master feeders, Full Floating master collets, Burns style taper lock master feeders, and the Super feeder. Sutton Tool Co., Sturgis, Mich.

18. Gage Setting. A better way of setting and checking thread gages has been proposed in booklet on screw gaging techniques. Standard Pressed Steel Co., Jenkintown, Pa.

19. Torque Testing Fixture. Typical applications are illustrated in brochure presenting torque testing fixture. Long columns, azimuth dials, power drive assemblies, proving rings, air operated rams, slide holders can be easily adapted to or used with fixture. P. A. Sturtevant Co., Addison, Ill.

(See Number 9)



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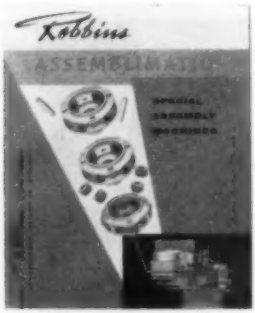

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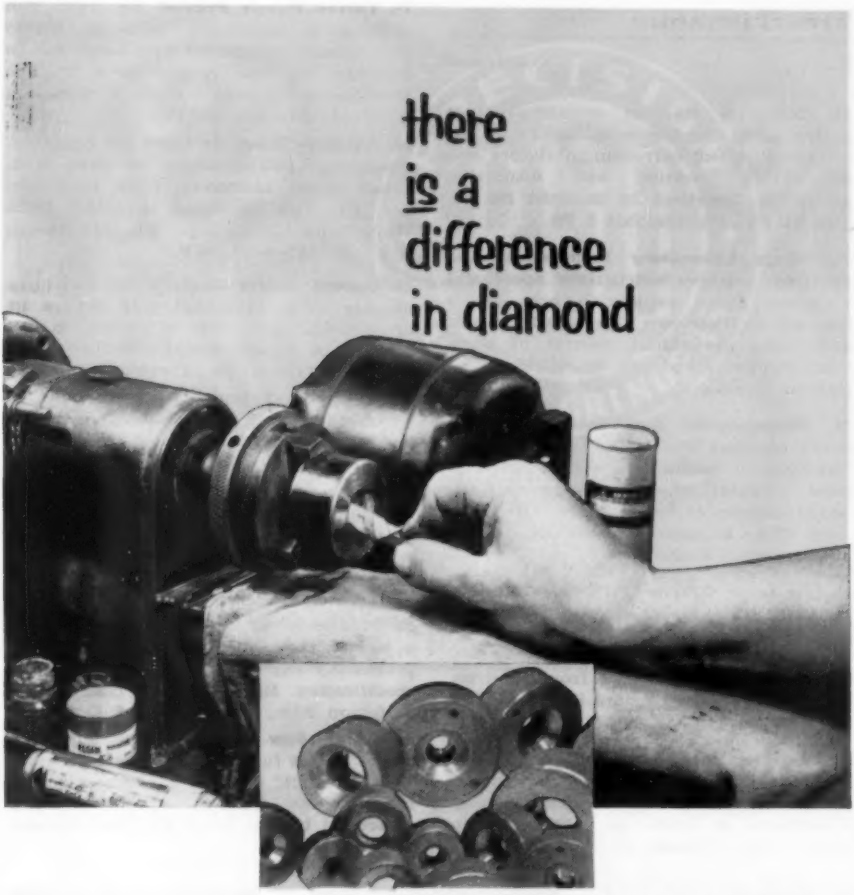

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20. Sulfonate OS, an anionic surface active agent for the manufacture of oil-soluble rust and corrosion inhibitors and emulsifying, wetting and dispersing agents, is described in Bulletin No. 51. Sun Oil Co., Philadelphia 3, Pa.

21. "Gage Laboratory Instruments and Services" features instructions, specs, and a layout guide explaining how plants may set up their own gage labs for closer and more convenient control of parts measurement standards. Sheffield Corp., Dayton 1, Ohio.

22. "Management Aids for Small Business" (Annual No. 3) contains sections concerning business-government relations; internal general management; external sources of help, advice, and guidance. Price 45 cents. Small Business Administration, Washington, D. C.

23. Overload Detector. Circuit Master Mark II, mechanical overload detector, shuts down automatic power presses before dies and tools are broken. Completely automatic. Leaflet from Wintriss, Inc., Dept. BB, 20 Vandam St., New York 13, N.Y.

24. Flexible Shafts, flexible shaft machines, saw attachments, hole cutters are described in condensed catalog. Wyzenbeek & Staff, Inc., 223 N. California Ave., Chicago 12, Ill.

25. Turret Punch Presses for short run piercing of component parts for trucks and related equipment are described in Bulletin No. 600-TR published by the Wiedemann Machine Co., 535 Wissahickon Ave., Philadelphia 32, Pa.

26. Abrasive Band Grinders for roughing, smoothing, fine finishing of steel, iron, brass, copper, aluminum, fibre, hard rubber, etc., are presented in folder from Walls Sales Corp., Dept. BB, 333 Nassau Ave., Brooklyn 22, N.Y.

27. Optical Height Gage, which measures heights up to 61 inches with accuracies of ±.000005" per inch of height, is described in 6-page folder. Webber Gage Co., 12912 Triskett Rd., Cleveland 11, Ohio.

28. Hydraulic Cylinders. Bulletin No. 57-68 shows recent improvements in design and additional mountings for "Compact" hydraulic cylinders. Vickers Inc., Detroit 32, Mich.

29. Pipe and Tubing. New 48-page catalog describes tube products ranging in size from ⅛" to 40" outside dia. Trent Tube Co., subsidiary of Crucible Steel Co. of America, East Troy, Wis.

30. Precision Balls. Catalog serves as guide to selection of precision balls for practically any requirement and material specification. Hartford Steel Ball Co., 12 Jefferson Ave., West Hartford, Conn.

31. Power Saw. Vertical feed Model 24 power saw is fully explained in brochure. This 24" x 24" capacity machine cuts off large billets, bars, tubing and heavy structural beams. DoAll Co., Des Plaines, Ill.

(See Number 21)

(See Number 25)

(See Number 29)

Three 6-18 Models . . . for Toolroom and Production Grinding

REID . . . the quality name in surface grinders . . . now has three different models in the 6" — 18" size. If your production schedule demands maximum automation, there's a REID 618P with power table and power cross feed. A REID 618PT with power table and hand cross feed is also available.

For tool and die makers, the hand operated 618H is ideal for precision grinding. On all models, a Cross Slide Lock is included as standard equipment.

Compare . . . check the extra features on all REID grinders . . . and standardize on quality. For complete details on models shown, write for Bulletin 618.

SPECIFICATIONS

Capacity: 6" wide, 18" long, 17¼" from spindle center to table. Standard wheel 7" x ½" x 1¼" included
Worktable: 51" x 8" overall; 6" x 18" working surface
Table Speed: Infinitely variable from 12 to 35 FPM
Cross Feed: Infinitely variable from .006" to .100"
Floor Space: 71" x 43½"
Weight: 3400 lbs.
Electrical: 3 phase, 60 cycle, 220, 440 or 550 volts
All Models Equipped with Automatic Lubrication as Standard Equipment

For Toolroom and Production Grinding of larger capacity, write for bulletin 824 describing our New All Electric 8-24 REID-O-MATIC Surface Grinder.

REID BROTHERS COMPANY, Inc.

133 Elliott Street, Beverly, Massachusetts

MANUFACTURERS OF PRECISION SURFACE GRINDERS AND PRODUCTION LATHES

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Free Literature

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32. "Directory of German Machinery and Equipment Manufacturers" is an 800-page book listing 20,000 manufacturers of all types of machinery, precision instruments and industrial equipment, classified in 9,000 product categories. Price $3.50. German American Trade Promotion Office, Suite 6900, Empire State Bldg., 350 Fifth Ave., New York 1, N.Y.

33. Hot Work Die Steel. Technical bulletin on three grades of hot work die steel covers elevated temperature physical properties meeting aircraft specifications for structural parts. Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.

34. Steel Tubing data chart fully explains tolerances for steel tubing and pipe—both seamless and welded mechanical tubing and seamless and welded stainless steel tubing and pipe. Peter A. Frasse & Co., Inc., 17 Grand St., N.Y.C.

35. Tapping Attachments that run in oil are discussed in Bulletin No. 22A. Capacities from 0 to ¾". Ettco Tool & Machine Co., Inc., 594 Johnson Ave., Brooklyn 37, N.Y.

36. Forging Hammer. Bulletin 361 describes piston-lift gravity drop "Rigidrop" hammer. Complete control of stroke variation allows operator to select from the full range of strokes by varying pressure on hammer's treadle. Erie Foundry Co., Erie, Pa.

37. Punches and Perforators. Manual illustrates more than 100 detailed die designs, has over 120 pages of text. Handbook offers a solution to punch breakage. Durable Punch & Die Co., 9030 S. Hermitage Ave., Chicago 20.

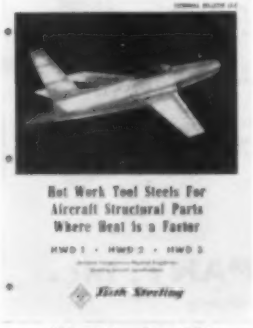
38. Indexing Machine Components. Eight page data sheet set presents specifications on standard components for 65" horizontal indexing machine. Hartford Special Machinery Co., Hartford, Conn.

39. Oil Base Additives. "Chemically Formulated Cimcut Concentrates" outlines the features of each of these oil base additives and their applications. Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati 9, O.

40. End Mills. New 16-page catalog shows complete line of high speed end mills with prices and dimensions. Technical data section well illustrated. Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.

41. "Metal Working Machinery," catalog No. 26, describes a variety of shop equipment and supplies, with special emphasis on the requirements of small and medium size metal fabricators. Julius Blum & Co., Inc., Carlstadt, N.J.

42. Spray Booths of every type, size and application are featured in Catalog I-7000. Contains all information necessary to select the right type, size and features of a spray booth. The DeVilbiss Co., Toledo 1, O.



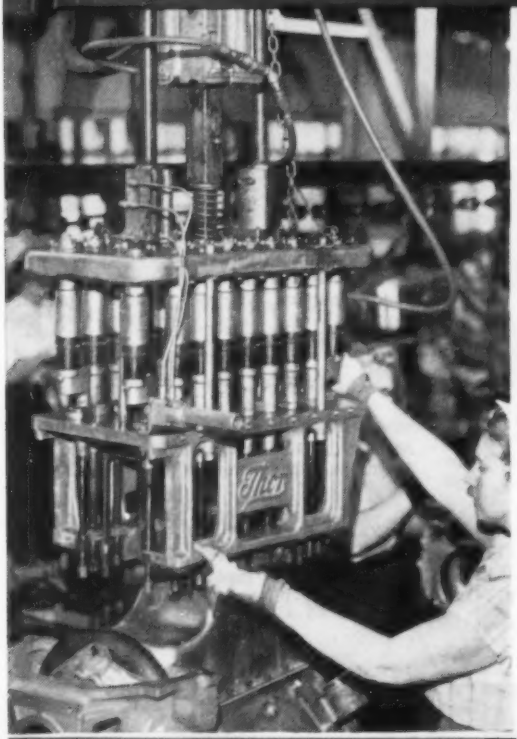
(See Number 33)

(See Number 35)

(See Number 36)

If you run two or more fasteners at the same time—cut costs with

THOR MULTIPLE NUTSETTERS AND SCREWDRIVERS



Any production assembly operation can enjoy the cost cutting benefits of automation thanks to Thor multiple nutsetters and screwdrivers. In jobs involving 2 to 20 or more nuts or screws, Thor multiples can return their cost in labor savings and improved quality control.

Thor multiples tighten fasteners to identical torque simultaneously with no shift in tensile load equilibrium which occurs when fasteners are tightened one at a time.

For the complete story of how Thor multiples can help you, write today for free book, *Automation in Assembly*. Thor Power Tool Co., Prudential Plaza, Chicago 1, Illinois.

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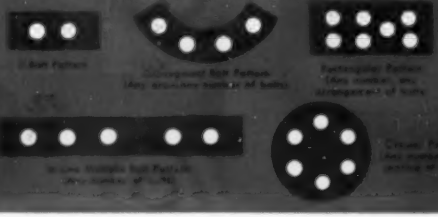
Thors PORTABLE POWER TOOLS

Thor multiple tools can be custom-built to any pattern, any number



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Free Literature

continued

43. Cutting Tools. Stupalox high-strength oxide-base cutting tools are detailed in a 12-page catalog published by Stupakoff Div. of the Carborundum Co., Latrobe, Pa.

44. Carbide Gages and threading tools are described in Bulletin Ct-56. Included are specifications and prices for plain cylindrical and thread plug carbide gages. Detroit Tap & Tool Co., 8615 E. Eight Mile Rd., Baseline, Mich.

45. "Welcome to Designers for Industry" introduces a company which offers the following services: tech. surveys; research and development; design engin.; ind. design; production engin.; engin. audits; transition mfg.; automation engin. Designers for Industry, 4241 Fulton Pkwy., Cleveland 9, Ohio.

46. Decimal Equivalent Chart and calendar (from July 1, '57 to June 30, '58) gives decimal equivalents of fractions from 1/64 to 1. Dayton Rogers Mfg. Co., 2824 13th Ave., South, Minneapolis 7.

47. Surface Grinder. Bulletin No. 177 describes the new No. 17 10" x 16" hand feed surface grinder. Covel Mfg. Co., Benton Harbor, Mich.

48. Tax Study. "High taxes discourage business development, reducing job opportunities," says booklet entitled "Expanding a Source of Tax Revenue." U.S. Chamber of Commerce, Washington, D.C.

49. Lathe. Bulletin No. CB257 covers the Series CB2-2516 lathe, 25" maximum swing clearance over bed and carriage wings and 16" over cross slide. Boye & Emmes Machine Tool Co., 81 Caldwell Dr., Hartwell, Cincinnati 16, Ohio.

50. "Activities and Purposes of the Air Moving and Conditioning Association" describes why the 59-company trade association was formed and how it functions. Air Moving and Conditioning Association, 2159 Guardian Bldg., Detroit 26, Mich.

51. "Industrial Gearing" outlines the design facilities and manufacturing capacity of gearing division, producer of custom-made gearing. Booklet B-7012, Westinghouse Electric Corp., Dept. RH, P.O. Box 2278, Pittsburgh 30, Pa.

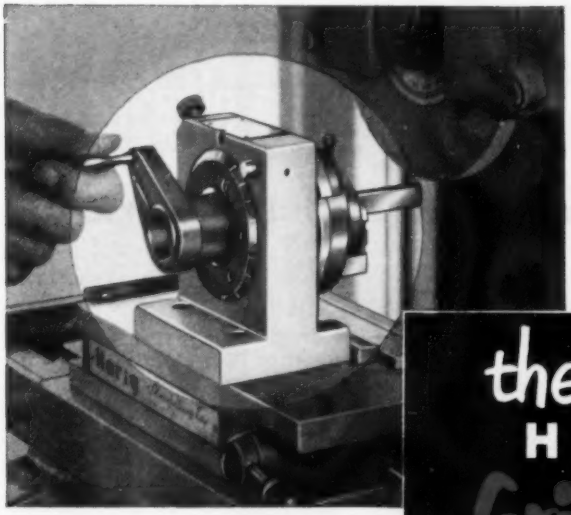
52. "The Facts of Life" on air and hydraulic devices (revised edition) gives a concise outline of how to proceed in installing hydraulic and pneumatic systems. Logansport Machine Co., Inc., Logansport, Ind.

53. Taps. Catalog makes tap selection and application easier. Gives information on class of fit, limit numbers, and gage data. Besly-Welles Corp., South Beloit, Ill.

(See Number 39)

(See Number 40)

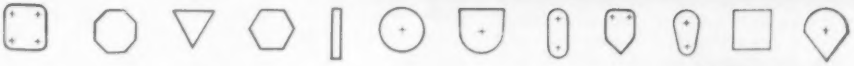
(See Number 42)



Easily grinds irregular shaped perforators concentric with shank within ± .0002 accuracy. Also can be used for light milling and boring fixture, inspection tool, etc.

Another advancement in perforator grinding...

the NEW HARIG Grind-All FIXTURE

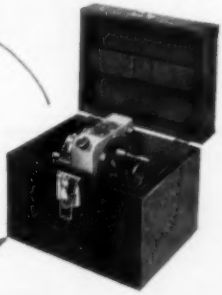


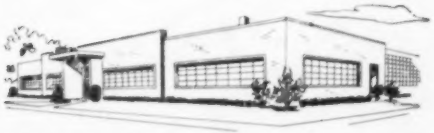
1 Single locking screw—fast action v-block adjustment holds it in desired position.

2 Handy crank speeds rotation of index plate.

3 Hardened and ground construction — a life-time of service and precision accuracy.

For your convenience . . . Handy Leatherette carrying or storage case supplied with Grind-All Fixture.





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Speeding Quick-Change Chuck Work

By **C. T. Bower,** A.M.I. Prod. E.
Tool Engineer
London, England

• Radial drilling machine operations using jigs are speeded considerably if a quick-change chuck is used for mounting the tools successively on the machine spindle. Each drill or other type of tool is mounted in a cylindrical holder, which can be inserted quickly into the fitting on the machine spindle, by the operator lifting a knurled sleeve and inserting the holder. When the sleeve is released, it drops and locks the tool holder automatically in place. The machine spindle need not be stopped when changing tools.

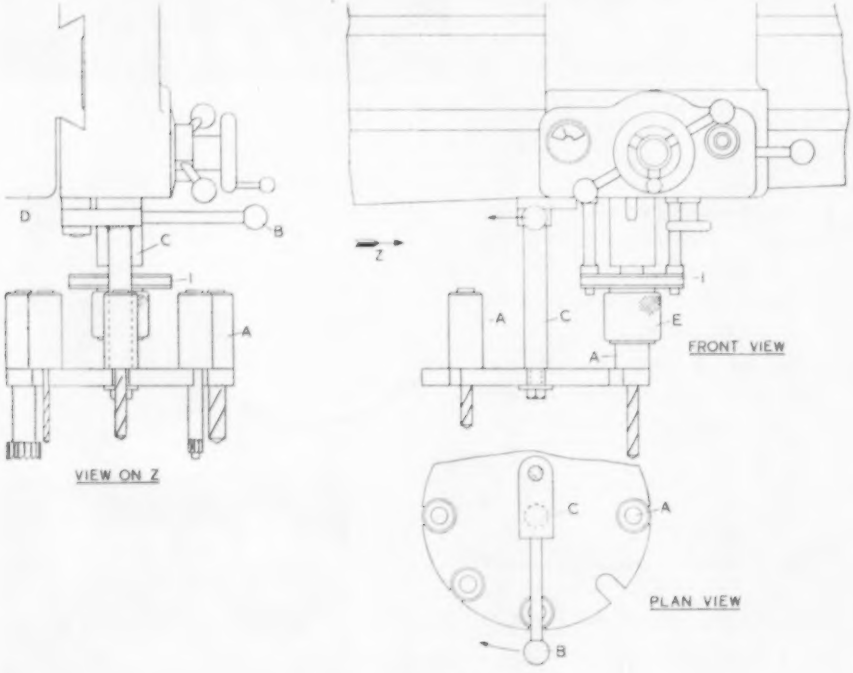
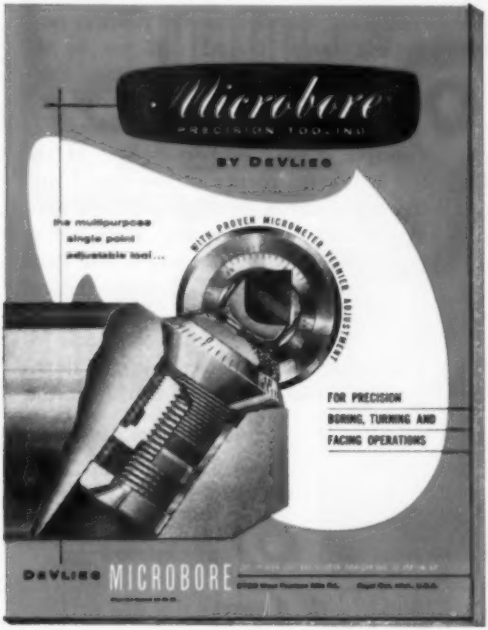


FIGURE 1

now a completely new DeVlieg Microbore Catalog

listing 332 standard general purpose boring bars

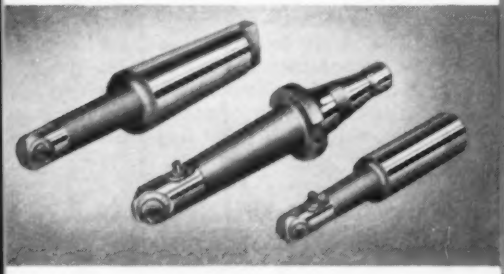


. . . FOR USE ON ALL MAKES AND TYPES OF BORING MACHINES, MILLING MACHINES AND TURRET LATHES!

Yes sir, you'll find it a constant aid. The new descriptive Microbore Catalog No. 58 presents a comprehensive range of newly designed Standard Single Tool and Two Tool Boring Bars, Boring Bar Sets and accessories. It also includes complete application, dimensional and carbide data.

Unique flip charts with simple engineering illustrations make it fast and easy to select the correct Boring Bar with NMTB Taper, Morse Taper or Straight Shank for a specific application.

STANDARD MICROBORE BORING BARS, BORING RINGS AND BORING RING ADAPTERS ARE AVAILABLE SINGLY OR IN SETS



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continued

A lot of the advantages of the quick-change chuck are lost, owing to the lack of arrangements for storing and handling the various tool holders which are to be used. It is not uncommon for 20 or more separate tools to be employed on a component; these tools must be used in succession, very often in a definite sequence. All too often, one sees the numerous tool holders scattered over the work table of the radial drilling machine in a haphazard manner. When a tool is required, the operator sorts through the heap in order to find it. With carbide tools, this scattering of tool holders over the machine table can cause chipping and damage of the cutting edges, in addition to the wasted effort and time of sorting them visually.

An improvement can be obtained by mounting the various tool holders on a sloping board placed adjacent to the left-hand side of the machine. Each tool has a set place on the board and is positioned in correct sequence. For example, tool No. 1 is placed at the top left hand corner of the board and the rest of them are arranged to be used in succession by working from left to right, as if reading the words and lines of a printed page. This arrangement is very good on small jigged work where the operator can reach with his left hand to pick up and put down cutting tools as they are transferred

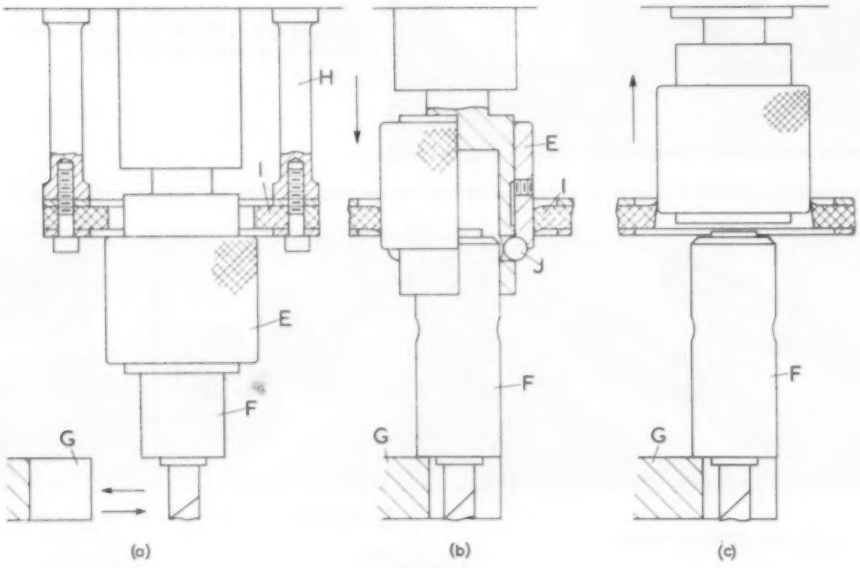


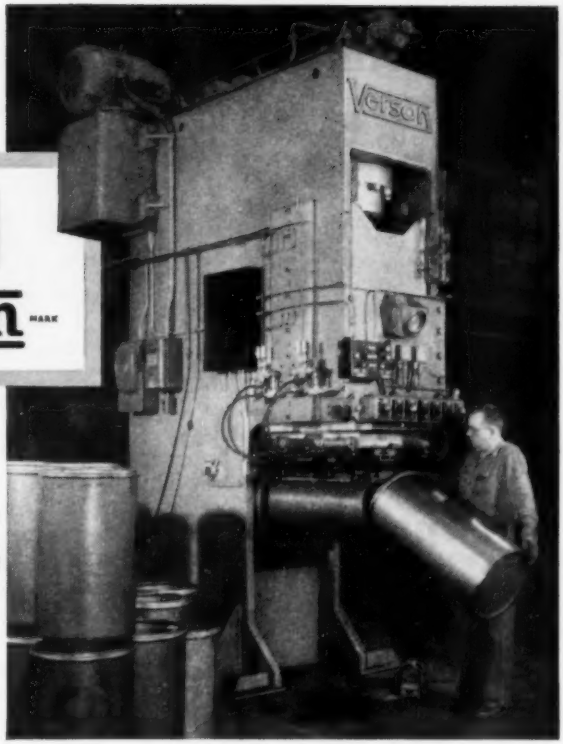
FIGURE 2

150 TON

TRADE **Verson** MARK

hydraulic HORN PRESS

coins and pierces openings on power line transformer containers



This 150 ton Verson hydraulic horn press is in use at the Gadsden, Alabama, Works of Allis-Chalmers Manufacturing Company.

The press is employed to automatically coin and pierce 3 different openings, to accommodate various sized leads coming into power line transformer containers. The press is equipped with full automatic electrical control and has varying tonnage control for each of the three stations.

This hydraulic horn, like all Verson machines, is a production process, engineered and built to provide greater efficiency and production with reduced costs.

Put Verson's production know-how to work for you. Send an outline of your requirements—we'll make specific recommendations.

152-A

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

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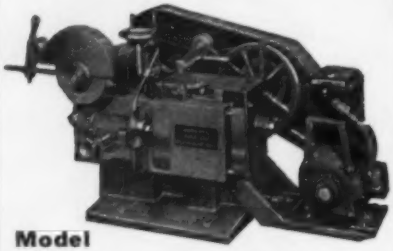
This Automatic
METAL SAW GRINDER



Model 35T

Sharpens up to 115 Saws .015 thick AT ONE TIME

This includes slitting and screw slotting saws and milling cutters. Takes saws from 2" to 5½" diameter. Completely automatic. No attention is required after machine is started. These ingenious, compact and sturdy grinders are saving and making money for their owners all over the world.

"35T" Cuts Costs . . . Makes Money For You! Send for 35T Bulletin

WARDWELL

3807 Ridge Road
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Maker of Largest Line of Saw and Tool Sharpening Machines

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from spindle to board and back again.

On large jigged work, the operator may have to take two or three steps to change a tool from spindle to storage board and back again. As radial drilling machines can have arms extending up to 8 feet or more, the distance between the tool storage board and the spindle can be considerable, when the spindle is near the extremity of the radial arm.

To avoid the operator reaching and walking, a fairly obvious step is to bring the collection of tools close to the machine spindle and, better still, make the tools move with the spindle carriage along the radial ram of the drilling machine. A further refinement is then to automate the changing of the cutting tools. This desirable aim is not achieved exactly in the arrangement to be described here, but it goes a long way towards it.

In Fig. 1 are shown various views of the tool storage arrangement. The tools "A" are stored in slots around the periphery of a disc, the diameter of which is made to suit the number of tools to be stored; it is an advantage to keep the disc diameter to the minimum. The cutting portion of the drill hangs down below the plate while the holder portion stands on the plate upper surface.

The plan view in Fig. 1 indicates how the tool holders are spaced around the disc and also shows the swivelling mounting which enables the disc to be moved clear of the drill spindle by pushing the lever "B" to the left. The disc is suspended on a rod "C" and it can be revolved freely on the rod axis to bring the various tool holders into line with the drill spindle. Referring to the front view, it can be seen that the rod "C" is secured to the spindle car-

Engineered with the quality features that make...

End Milling Jobs Pay Off!

Engineered with the hardest practical grade of carbide to "breeze" through the toughest metal cutting applications. Nelco end mills are precision ground all over—from shank to cutting edge.

174 different end mills—diameters from ¼" to 5"—2, 3, 4, 5 or 6 flutes—straight or taper shank—a tool for every application! The complete Nelco end mill line means a tool for every job—from stock—without the delay and cost of a "special".

Your equipment relies on its tooling for production—and in any machine—new or old—Nelco carbide tipped tools really PRODUCE!

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continued

riage casting and therefore, the collection of tools moves with the carriage as it is traversed along the radial arm "D" of the machine.

By storing the tools on the circular plate they are always in a fixed relation vertically to the machine spindle and this enables the action of chucking the holders to be partly automated.

Referring to Fig. 2 and to the left hand view (a) of the spindle. The vertically sliding sleeve for operating the quick-action chuck is at "E" and a typical tool holder is at "F". The edge of the tool storage disc is at "G" and the arrows indicate its movement to and from the spindle centre line. A pair of pillars "H" are secured to the underside of the machine spindle carriage and support, at their lower ends, a sleeve actuating ring. This ring is made up from a flexible rubber ring "I"—supported on either side by a pair of annular steel rings.

In the left hand view (a) the spindle can be fed downward to engage the cutting tool with the guide bushings in the jig in the normal manner. When the drilling operation is completed, the spindle is lifted upward and the sleeve "E" passes up through the rubber ring "I" which exerts a resilient grip on it. The operator then moves the tool holding plate to the right to bring the vacant slot in the tool storage plate into line with the machine spindle axis. If

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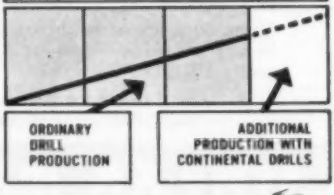

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the operator now moves downward the spindle through a short distance, the sleeve "E" will be held upward by the grip of the rubber ring and the drilling tool will drop down on to the storage plate. This action taking place can be seen at view (b) in Fig. 2. The operator then moves the spindle up as far as it will go so that the tool holder is clear of the chuck, as at view (c).

The tool holding plate can now be turned on its axis to bring the next tool into line with the machine spindle which is then fed downward to engage the holder of the new tool. The action, during the initial stages of engaging the chuck with a new tool can be seen from view (b). The spindle is moving

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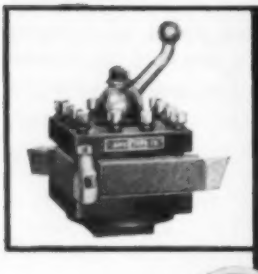
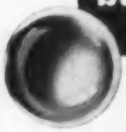


by being on the ball!



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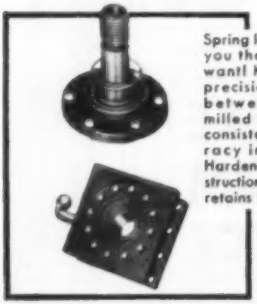

Spring loaded balls give you the accuracy you want! Hardened steel precision balls locked between accurately milled spherical seats consistently give accuracy in re-indexing. Hardened all steel construction minimizes wear, retains built in precision.

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Shop Hints

continued

downward and the sleeve is held up by the rubber ring. Since the sleeve is clear of the driving balls "J" in the chuck body, they will be pushed apart by the tool holder as the spindle is moved downward. Continued downward movement of the spindle will bring the top of the sleeve clear of the rubber ring. The sleeve will then drop and lock the driving balls into engagement with the notches in the tool holder. The position will then be as at (a) and the tool holding plate is moved leftward away from the spindle.

When the tool is to be changed, the tool holding plate can be moved into line with the machine spindle once more, the vacant slot being ready to receive it.

Although the movements described appear to be complicated, they can be carried out in a fraction of a second by using the fast sensitive feed handles for the spindle. The amount of spindle traversing needed is governed by the length of the longest tool in the set. This must clear the top of the jig when it is standing on the tool storage plate. The height of the radial arm is then set so that the tools will be clear of the jig when released. From this, it will be clear that the method will work most efficiently with cutting tools which are nearly of the same length. Tools which require the radial arm of the machine to be adjusted up and down the pillar during a cycle of operations are very rare, however, and the principle of having a tool set which travels with the spindle carriage can be adopted without difficulty on most radial drilling machines. • • •

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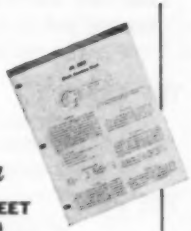

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continued

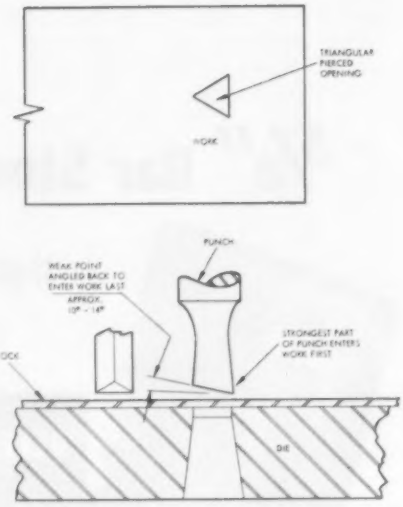
Providing Shear to a "V" Shaped Punch Without Weakening It

By **H. J. Gerber**

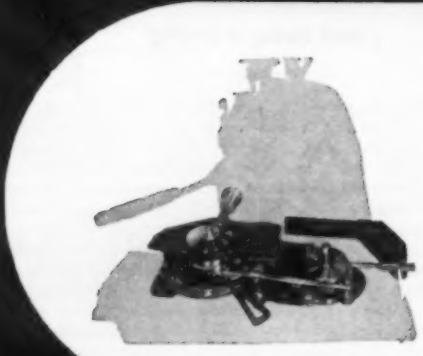
● Often it is desirable to provide shear to punches which will be used to pierce thick stock. This may involve risk of punch breakage on certain shapes such as the one illustrated unless properly designed.

One case of this sort proved successful when the face of the punch was angled back to permit one full edge of the triangle to enter the work before the remaining sharp apex. This arrangement still provides the benefits of shear without danger to the punch.

• • •



The *Dearborn* AUTOMATIC INDEXER . . .



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For detailed Bulletin No. PS-12, Write:
The Lodge & Shipley Co., 3074 Colerain Ave., Cincinnati 25, Ohio

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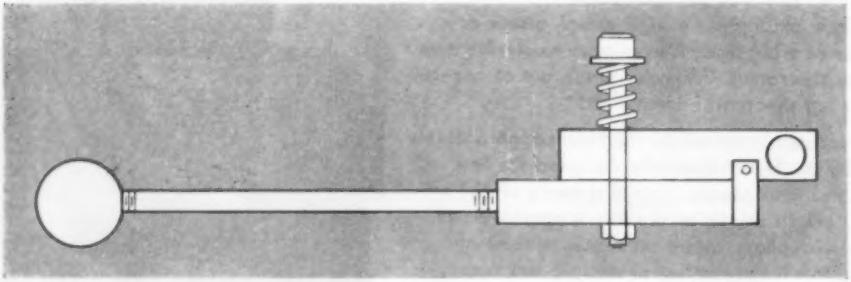
Band Saw Length Gage

By **H. J. Gerber**

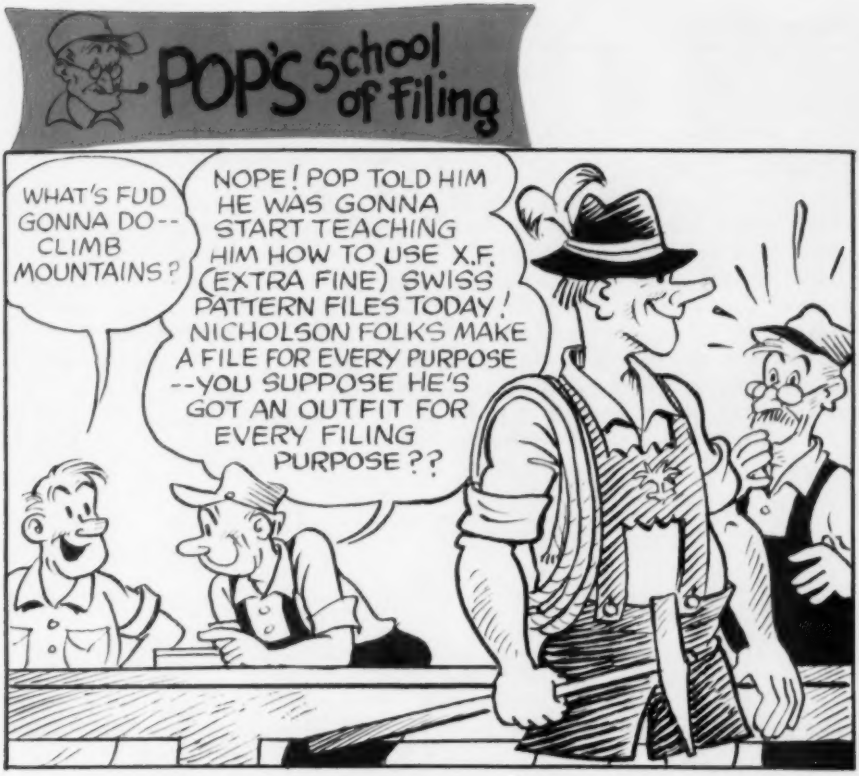
• Like many other shops, we buy our band saw blade stock in 100-ft. pull-out containers and cut off individual blade lengths as needed. Having often been irked by the nuisance of having to use a tape measure to gage off the required blade length we devised a simple, permanent, and very convenient floor gage. We simply measured off the correct length on the concrete floor nearby to the bandsaw. A mark with an indicating arrow and the words "band saw" were chiselled into the floor at each extremity of the required length. White paint was then brushed into these markings to make them more conspicuous. • • •



Pressure Control For Drill Press

By **Clifford Molloy**

• We have a production drill press department in our plant and have been running a job which required drilling of small diameter deep holes. We are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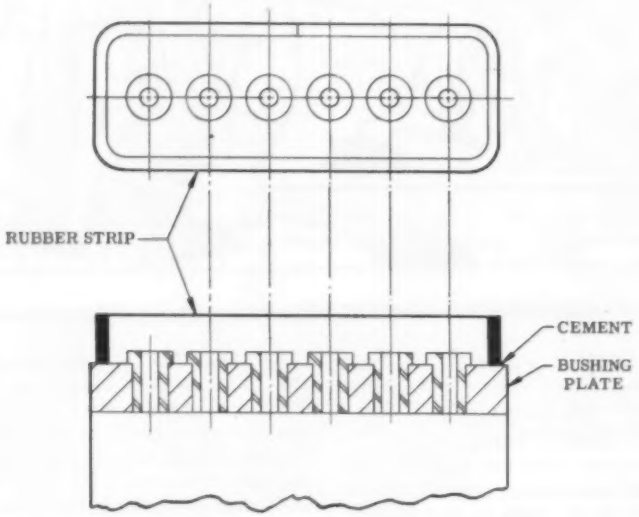
continued

using bench drill presses for this work.

This would be a simple job in the tool room but under the monotony of a production schedule the operators sometimes forget themselves and really "lean" on the drill. The change in angle of the feed lever results in variations in the pressure applied. Some of the operators were overly cautious and fed the drill very slowly. This saved the drills but production was low. To reduce the drill breakage resulting from excessive pressure, and to improve production, we added a pressure control feature to each drill press. This consisted of a steel block secured to the feed shaft and a second block pivotable mounted on the first.

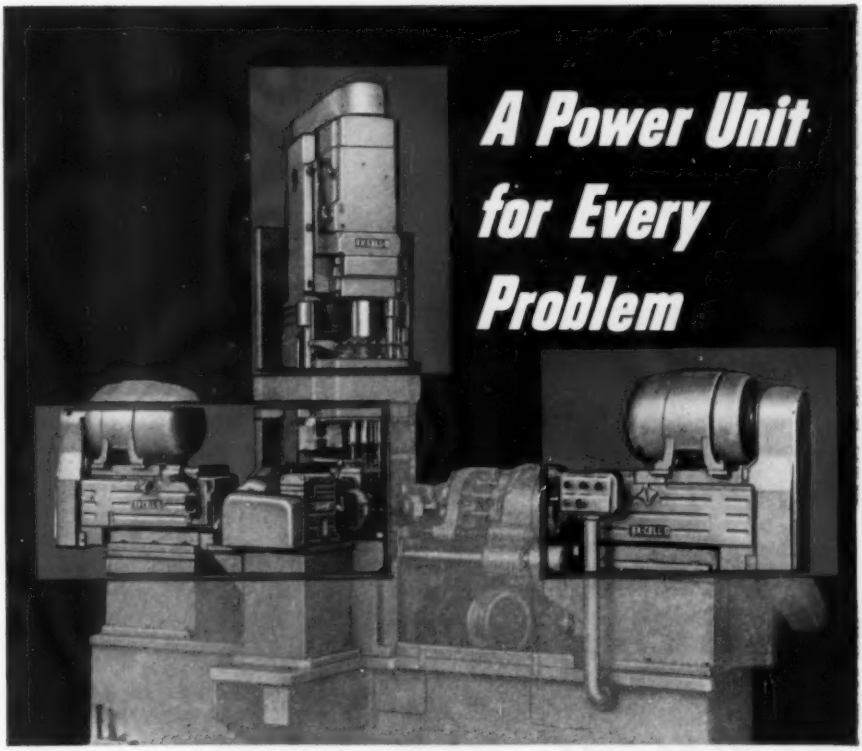
An adjustable spring holds the block together until excessive pressure is supplied to the feed lever. The operator can readily feel the blocks separate and can reduce the feed pressure accordingly. The correct pressure was determined by trial and then measured by a spring scale applied to the lever. This permitted setting all drill presses at the same pressure. • • •



Rubber Well Concentrates Coolant Flow

By **Roger Isetts**

• Many times on drill jigs that have a number of holes that must be drilled all at once on a multiple drill, difficulty is encountered in concentrating enough coolant on the drills. This is especially



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true if increased speed and feed is desired or the material being drilled is of tough quality. A simple inexpensive solution to this problem is to form a well around the drill bushings. This can be easily accomplished by taking a rubber strip approximately ¼" thick and cementing it to the top of the bushing plate around the bushings. Thus only one coolant pipe is needed to fill up the well as the drills are cutting because coolant is always flowing around the drills in a continuous bath.

This method also eliminates the mess that usually occurs when using individual sprays on each drill. • • •

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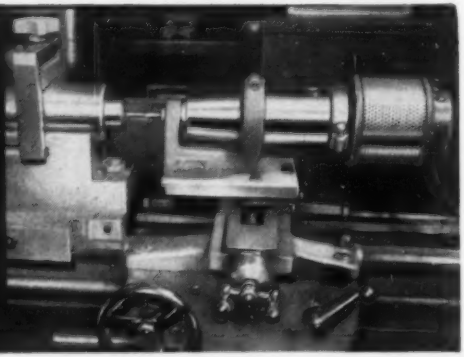

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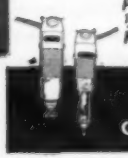

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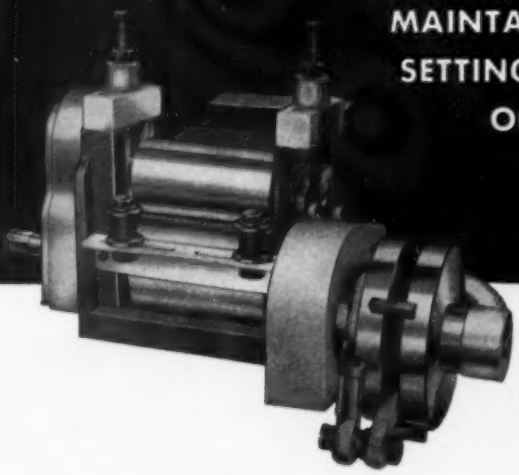

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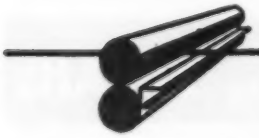

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Many thicknesses and sizes of metal are cut on this Steelweld Shear every day. Thanks to Steelweld's exclusive MICRO-SET knife adjustment, it is easy to set the knife clearance to the exact amount which will produce the best cut for every plate run through the machine.

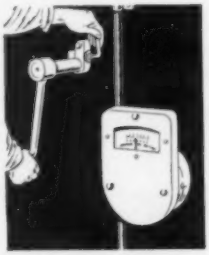
If desired, the knife clearance can be set for an average thickness and all plates cut without changing the clearance. This procedure is used with most shears because to change knife clearance on them is a tedious, difficult operation which usually puts a machine out of service for hours.

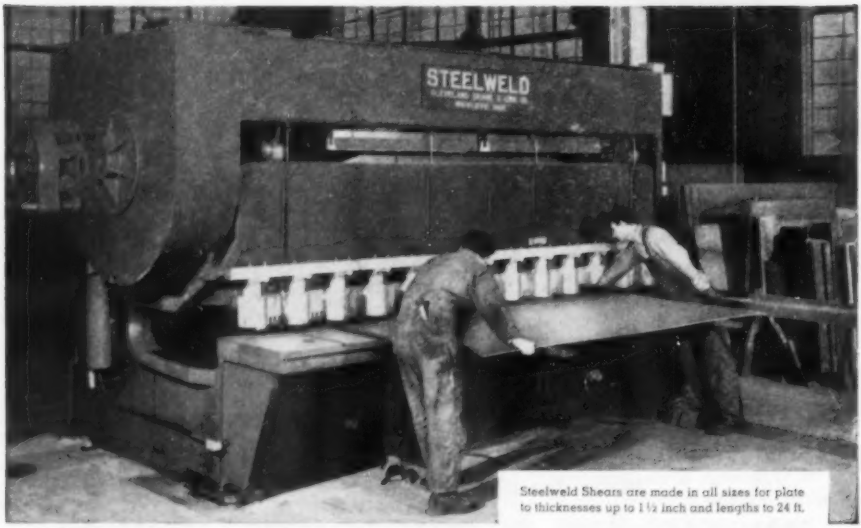
In contrast, knife adjustment on Steelwelds is made in a few seconds. It's simply a matter of turning a crank until an indicator points to the figure representing the thickness of plate being cut. No bolts to loosen; no parts to move. There is no need for using "average" knife settings.

The clutch and brake unit is another outstanding feature of Steelweld Shears. As it is air-operated, it is quick, snappy in action. Its low-inertia design assures cool operation, even after long continuous production runs, because energy to be dissipated is minimized and working pressure necessary on clutch and brake facings is greatly reduced.

The many features of Steelweld Shears make it worth your while to get all the facts.

Because of MICRO-SET Knife Adjustment





Steelweld Shears are made in all sizes for plate to thicknesses up to 1½ inch and lengths to 24 ft.

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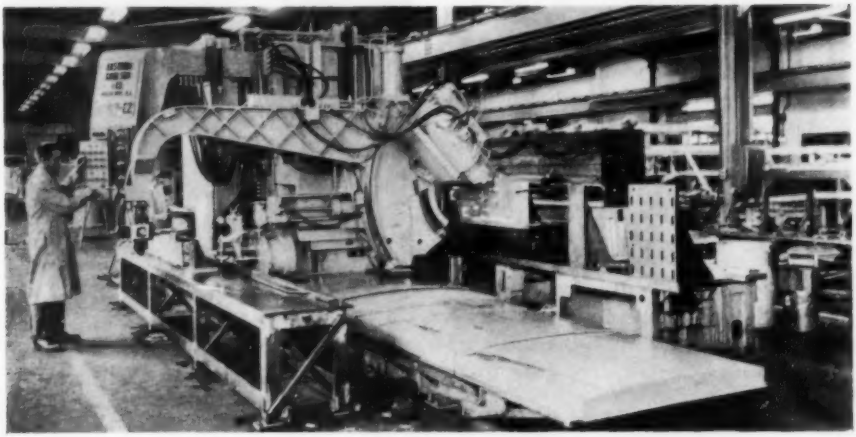


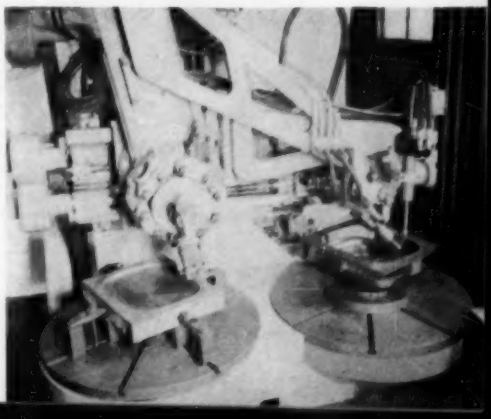
Machining air frame for jet aircraft with Turchan Servo-controlled tracer on Ekstrom-Carlson Mill.

Tracer Control System Reduces Set-up Time

DETROIT—A standard vertical mill at Foye Mfg. Co. employing 12 men, was equipped with a Hydro-Magnetic tracer to machine a jet aircraft component requiring facing, contouring, and grooving. Originally requiring 20 set ups, the job was reduced to two set ups and more parts were produced in one month than had previously been produced in a year. The material was magnesium.

The Turchan Hydro-Magnetic tracer causes the stylus to actually cling to the template and move the tool in a range of 360° without interruption and with no assistance from the operator. This unit is used on vertical mills and also on Turchan's new 2-spindle Hydro-Router, that can machine two parts simultaneously from one master.

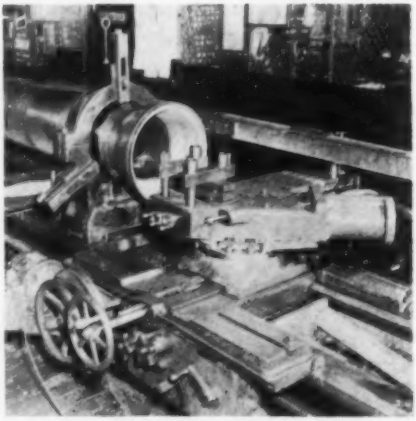
TRACER CONTROLLED standard vertical turret lathe. The auxiliary table rotates under control of the tracer and template control.



continued

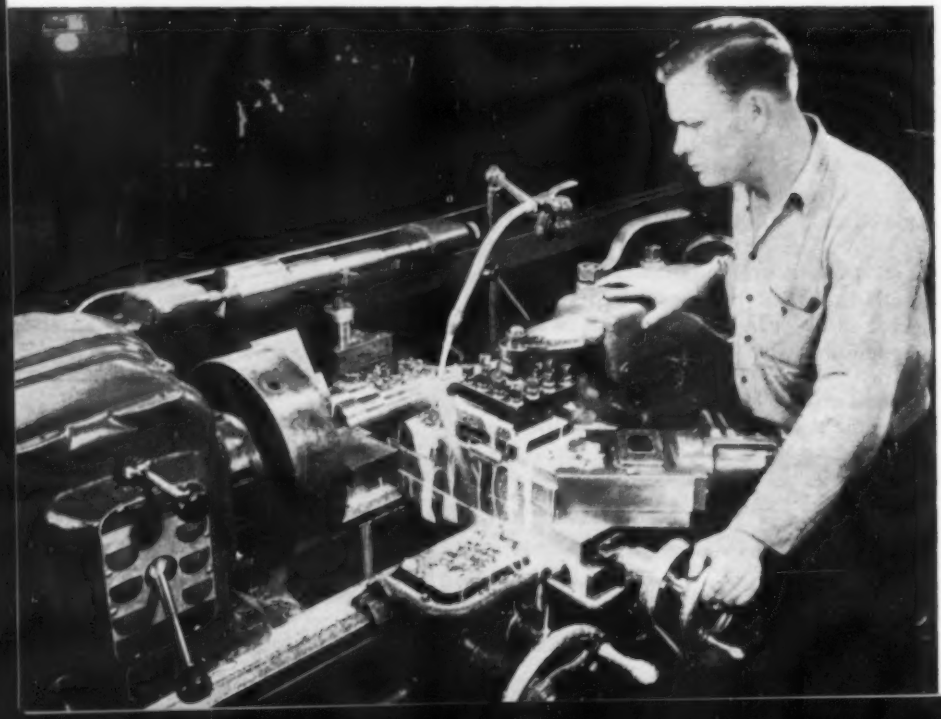
The most recent Turchan development is a new tracer control for lathes. The lathe is equipped with a single lever control permitting three changes of operation from feed, to thread, to tracer and does not restrict the normal lathe swing or adaptability to standard use. It is also capable of cutting shoulders left or right, up or down and assures a completely step less feed.

The accompanying photos show the wide application of tracer controls and the machining jobs shown cover a range of users from plants with less than ten employees to those which employ thousands. • • •

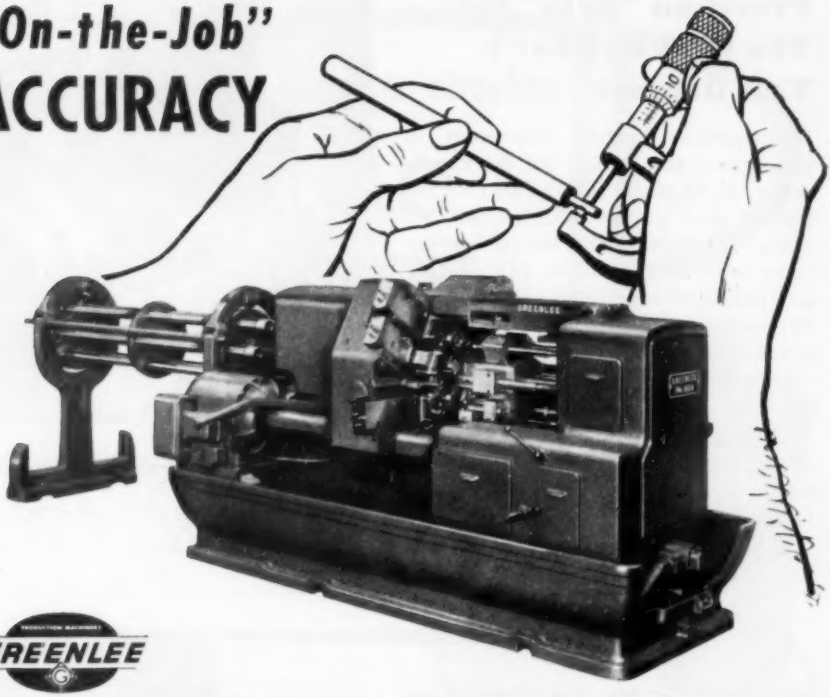


U. S. Pipe and Foundry use Turchan Tracer controls to machine molds for cast iron pipe.

Carrying a stock replacement of shafts for large electric motors is costly. Using a tracer controlled lathe this manufacturer simply stocks one template or model from which exact duplicates can be turned when needed.



"On-the-Job" ACCURACY



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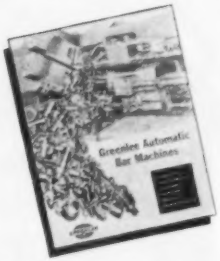

Write today for Catalog A-405, first step on the way to more profitable production with Greenlee Automatic Bar Machines.

Modern production demands greater accuracy . . . at greater speeds. Greenlee Automatic Bar Machines maintain rigid production schedules and hold each piece within required tolerances. Let Greenlee engineers show you how Greenlee Automatics save time and money. It will pay you to investigate.

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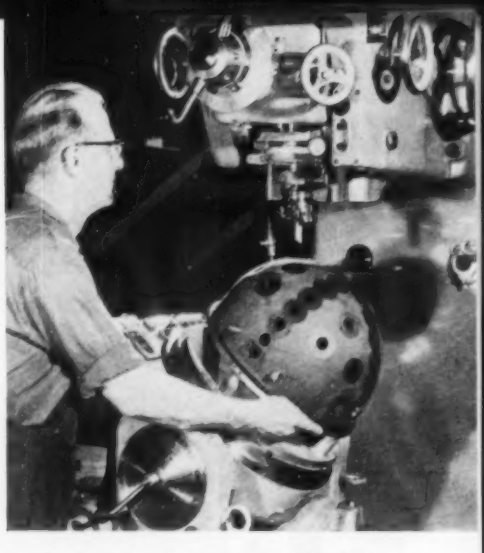
Precision "Eyes" for The B-52 Bomber's Tail Defense



MINNEAPOLIS—Critical dimensions in this optical test fixture for the Hemisphere Sight of the MD-9 Tail Defense System used in the B-52 bomber, involve: (1) locating and boring bearing holes to ± .0002, —.0000; (2) locating and boring 49 holes; and (3) milling a flat surface with first class microfinish around each hole to angular position within ± 2 minutes for mounting optical lenses.

Produced by the Mechanical Division of General Mills, Minneapolis, the text fixture shown being machined on a German-built Lindner Optical Jig Borer with tilting rotary indexing table is used for checking out Hemisphere Sights production.

General Mills estimated that the machine time in the Lindner Jig Borer was

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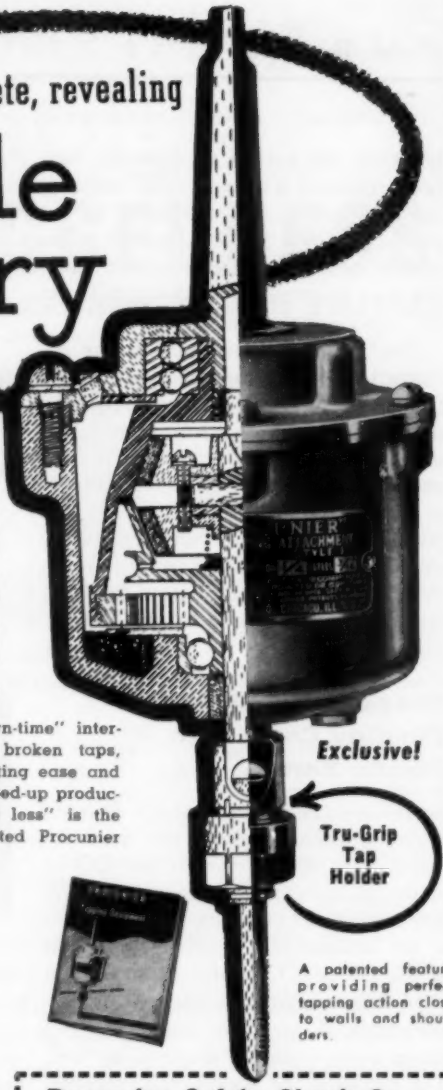
Inside Story

on the finest tapping heads ever made!

Here's a feature by feature analysis on the amazing Procunier tapping line which clearly explains why they have consistently maintained tapping superiority in the industry for over 30 years! A true "peep-hole" story on the many outstanding construction improvements, the mechanical advancements and precision quality operating advantages that make Procunier heads a "must" in production plants everywhere! You'll learn why Procunier means more tapping hours with a minimum of "down-time" interruptions, accelerated production with fewer broken taps, fewer spoiled pieces and a "new-found" operating ease and convenience that helps operators maintain stepped-up production schedules. "Do more tapping, better, for less" is the slogan in progressive plants who have adopted Procunier heads in *their* tapping departments.



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A patented feature providing perfect tapping action close to walls and shoulders.

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continued

less than one half of what would have been required with any other machine or combination of machines in the plant. This was possible because of the optical measuring system of the Lindner and its preselective Autopositioner for rapid table settings.

The Autopositioner enables the operator to preselect the table position for the next hole while one boring operation is in progress, thus eliminating non-productive time between holes. As one hole is completed, the table moves in rapid traverse to the next pre-selected position. With the flat surfaces around each hole a particularly critical requirement, locating was done from the bearing holes previously bored on the same machine. • • •

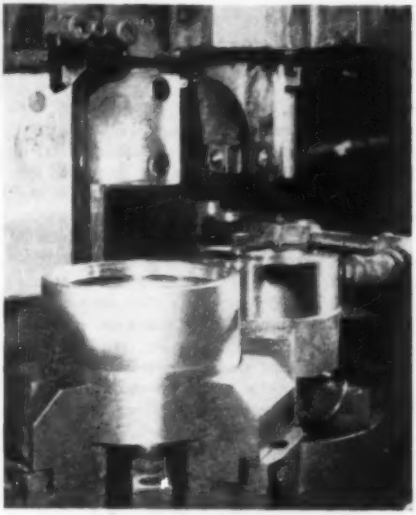
Chrysler Plant Cuts Turning Costs with Boring Bars

INDIANAPOLIS—The use of the Wesson micro-adjustable throw-away idea for turning, as in the case of the OD of planet pinion carrier housings on Bullard vertical turret lathes, is the practice at the Indianapolis Transmission Plant of the Chrysler Corporation.

In this operation, a Wesson micro-adjustable throw-away insert tool replaces a conventional single point tool. The nature of the operation on the machine formerly made it necessary to reset the tool by gage every time it was sharpened to compensate for reduced length. Ten minutes was the normal time required for a tool change.

The use of a Wesson micro-adjustable tool with square precision ground Wessonmetal GI inserts eliminated the difficulty without any change in operating specifications. Speeds, feed and depth of cut remained the same. Tool costs dropped as much as $4.04 per 1,000 pieces.

Since the only change in the tooling is to index the insert or replace it after



indexes, no tool-change-adjustment is required. The micro-adjustment took care of the initial set up.

Indexing time of less than 60 seconds represents a saving in down-time per tool change of about 9 minutes. In addition shut-down for tool changes are needed only about half as often in view of the performance of the Wessonmetal carbide, so that total down-time for tool changes is now only about 7% of the former average. • • •

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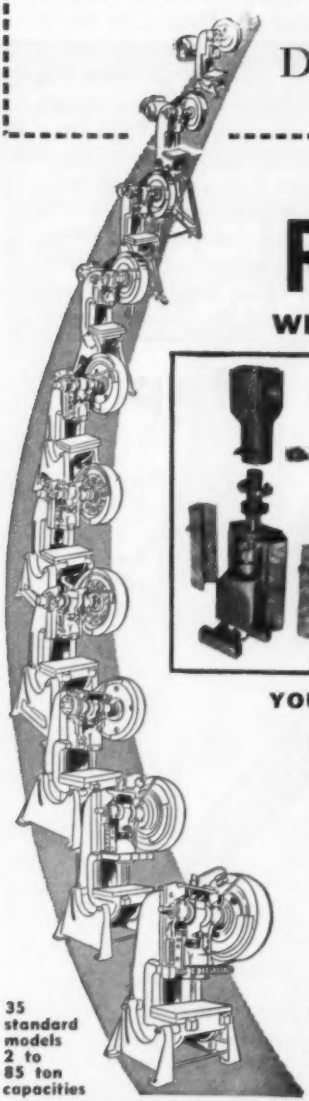

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- ***Heavy semi-steel frame with specially designed reinforcements****
- ***Wide main bearings***
- ***Oversize crankshafts***
- ***Full Vee ramways***

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Making Inspection of Metallic Defects in Crankshafts Easier

CLEVELAND—One of the most important inspection duties at Ohio Crankshaft Co., Cleveland, is in the Magnaflux Testing Machine Department where crankshafts and camshafts are inspected for metallic defects. A Magnaflux operator squirts an oil-base solution containing magnetic particles over the webs of a crankshaft. Defects in the metal are determined magnetically, the particles being drawn to defective areas.

Once a defect has been detected, the operator must wipe the fluid from the crankshaft web and paint the area with yellow paint to mark the location of the flaw. In order to apply the paint properly, the oily solution has to be removed. The operator uses several paper wipers to clean the oil base solution from the crankshaft web, to wipe ex-

sharp as a tap

with the *Rocket*

TAP SHARPENER

MODEL 50
for 2, 3, 4 flute taps
collet capacity
to 1-1/16"

MODEL 60
for 4, 5, 6 flute taps
collet capacity
to 2-1/4"

- *low cost*
- *quick*
- *accurate*
- *push button controls*
- *no cams required*

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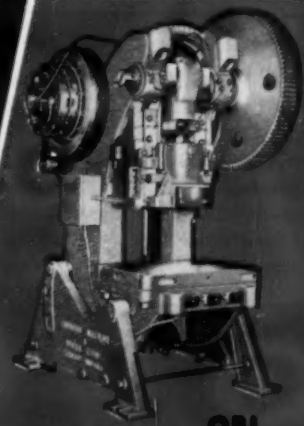
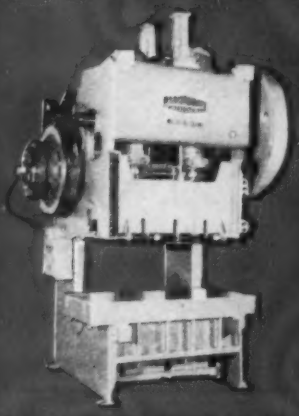


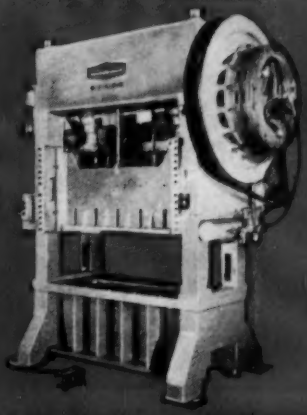
OBI

20 Models ranging from 16 to 150 tons capacity in regular, special wide or high speed types—pin or air clutch.



GAP DOUBLE-CRANK

60-100-125 and 150 ton capacities, steel fabricated, air clutch, flywheel or geared models.



STRAIGHT SIDE DOUBLE-CRANK

60-80-90-100-125 and 150 ton capacities. Tie rod, steel construction and air clutch.

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continued

cess paint from the defective area, and to clean his hands which become oily and grimy.

Drilling oil holes in crankshafts presents another difficult wiping job. The heavy-duty diesel crankshafts weigh several hundreds of pounds. To facilitate drilling, a number of lubricants are used.

After drilling, the crankshaft literally is covered with these materials. In addition, pieces of metal filings and shavings from the drilling operation are mixed in with the lubricants. The crankshaft, however, is wiped clean of all these materials with disposable paper wipers in a matter of seconds. • • •

Shear blade grinding operation (left) and view of shear blades and magnetic chucks (right) from one end of Mattison Grinder.

Grinding Shear Blades at Ohio Knife

CINCINNATI — Operations on shear blades are highly important, both in original manufacture and resharpening as occasion requires. The longer the blades involved, the more important it becomes to hold close tolerances. Many users of long shear blades find it more consistent to return them to the manufacturer for resharpening than to

maintain suitable equipment in their own plant for the purpose.

At Ohio Knife Company, in Cincinnati, where various types of long knives are made in addition to shear blades and other work, necessary know-how and equipment are both at hand for doing such work. An interesting case in point can be seen in the illustrations, where a Mattison traveling-table grinder of the type incorporating an especially massive vertical spindle is being used for resharpening shear blades. Blades being ground are 123" long by 2⅞" wide by 11/16" thick, and a finish entirely suitable to the work is being obtained.

Wheel speed employed on this work is 580 rpm, and table speed used is 100 feet per minute, a 28" x 24" x 5" wheel being used. Transparent Cimcool is used on this job, being mixed with water 140 to 1.

One outstanding reason for using particular care on this type of work is that warpage must be carefully avoided. Approximately .012" of stock is removed in the sharpening operation, and the blade is left accurate to within .001" from end to end. • • •

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CLEVELAND TAPPING MACHINE CO.

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. . . want to know how to increase production efficiency and at the same time decrease production costs?

. . . want to know how to install complete mechanization with controlled capital investment?

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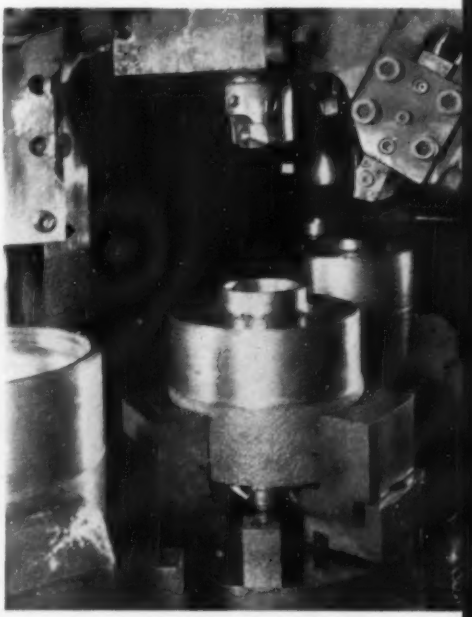
continued

Precision Boring With Throw-Aways Eliminates Reaming

Tool change down time also cut over 90%



INDIANAPOLIS—Substitution of Wesson micro-adjustable boring bars with square throw-away inserts in place of 2-bladed carbide reamers—without changing speed or output rate—has not only improved the finish produced but reduced tool costs from $35. per 1000 pieces to 22 cents per thousand.

The surprising improvement was obtained on one station of Model K Bullards machining pearlitic planet pinion carrier housings of about 200 Brinell at Chrysler's automotive transmission plant.

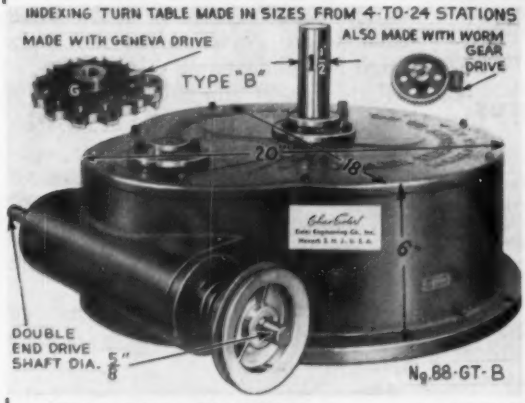
With tooling formerly employed, considerable difficulty was experienced in keeping the reamer properly centered. With only 100 pieces producible per grind, it was necessary to keep a supply of reamers on hand at the machine, in the tool crib, and in the grinding room, to prevent protracted shut-downs for tool changes.

As shown by the accompanying table, shut-downs for tool changes were cut 75% by the adoption of Wesson throw-away insert boring bars. While the bar is micro-adjustable, this adjustment was used only in initial setups. The use of Wessonmetal WH precision ground inserts has made adjustment practically unnecessary. When worn, the insert is simply indexed to a new edge.

The use of throw-aways eliminated all tool grinding, cut needed tool inventory to a small fraction of that formerly necessary, reduced tool change time from 4 minutes to a maximum of 60 seconds. Number of tool changes also were reduced by 75%. • • •

	BEFORE	AFTER
Tool used	2-bladed Reamer	Micro-adjustable throw-away insert bar
Carbide used	C-6	Wessonmetal "WH"
Cutting speed, rpm	155	155
Feed rate per revolution	.012 ipr	.012 ipr
Depth of cut	.010	.010
Machining time	4 minutes	(cycle unchanged)
Tool change time		60 seconds
Pieces per tool change	100	400
Pieces per blade or insert, total	400	3200
Grinding cost, each	$0.875	(eliminated)
Total grinding cost per tool	$3.50	(eliminated)
Initial tool cost	$11.50	$0.72/insert
Total tool cost per 1000 pieces	$37.50	$0.22
Total tool change down time per 1000 pieces	40 minutes	2-½ minutes

INDEXING MACHINERY — CAMS — GENEVA GEARS — TURNTABLES



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continued

Triple-Action Presses For Ford Body Stampings

CHICAGO HTS., ILL.—Anticipating the automobile of tomorrow, the Ford Motor Company is operating two triple-action presses—the largest ever built—in its Chicago Heights stamping plant. With bolster and blankholder dimensions of 200 by 100 inches, they will handle body stampings as large as any likely to be specified in the design of future cars.

The presses, built by Hamilton Division (Hamilton, Ohio) of Baldwin-Lima-Hamilton Corporation, feature bottom drive construction. This permits both upper slides to be pulled down by slightly stretchable rods allowing production of stampings of slightly varying thickness without blankholder adjustment.

The Hamiltons incorporate packaged design that has afforded a streamlined unit, with all controls—mechanical, electrical and pneumatic—designed integrally with the press and confined within the press framework. This allows quick and easy initial installation as well as maximum operator safety plus ease of operation and maintenance.

Improper slide timing is prevented by mechanically synchronized actuation of all three slides from a single main drive. Air or electrical failure will not affect synchronization, and breaks in timing—easily possible in double drive schemes—are impossible in the triple action Hamilton single drive system.

Eddy current clutches and electrical brakes were incorporated for variable-speed operation. These provide optimum speeds during each portion of the cycle—fast for non-productive portions when advancing to and returning from the work—slow for the work portion.

Other available drive options include a direct motor drive and a friction clutch with brake unit.

Heavy, well-proportioned press components were used to provide maximum strength and rigidity. Positive lubrication of all moving parts is assured by an automatic system—the lower operating mechanism by circu-

lating oil, minor parts by a centralized grease setup.

Sequencing of the three actions consists of:—

1. 800-ton blankholder pulled down, holds blank.
2. 800-ton inner (upper) slide pulled down, makes a draw.
3. 550-ton lower slide pushed up, makes reverse form or blanking operation.

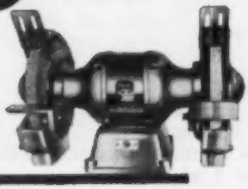
Speed of operation is 9 strokes per minute. The main drive is a 250 horsepower motor.

Most of the operating mechanism—integrated into the lower part of the press below main floor level—is conveniently accessible from the basement for inspection and maintenance.

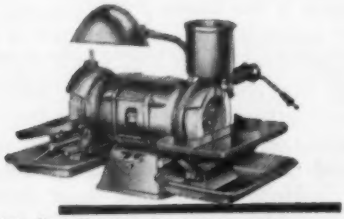
Bottom drive construction affords a compact installation requiring only 19 feet of headroom, a 17 foot basement. Area of the inner slide is 188 by 80 inches, the lower slide 192 by 71½ inches.

LESS VIBRATION . . . GREATER ACCURACY!

Baldor GRINDERS



183-10" Grinder. Every part oversize and ruggedly constructed for hard, continuous use. 1 HP, 1725 RPM. Wheels: 10" x 1" x ⅞" — 36 and 60 grit. Ideal for grinding large, odd-shaped pieces. **$148.00.**



Carbide Tool Grinder. Sharpens quickly, accurately. Reversible ½ HP motor withstands repeated overloads. 1½" wide wheels. **$171.70**

Dynamically balanced Baldor Grinders provide smoother operation, far greater accuracy. Assure hours of relaxed, fatigue-free operation. Rugged . . . durable . . . the first choice of old hands who have tried 'em all.

- Lubricated for life ball-bearing motors never need servicing!
- Splash-proof, totally enclosed motors protect against dust, dirt, grit. Can't cause trouble.
- Models for every need! ¼ to 3 HP, 6" to 12" individually balanced wheels. Bench and pedestal types.
- Every model fully guaranteed.

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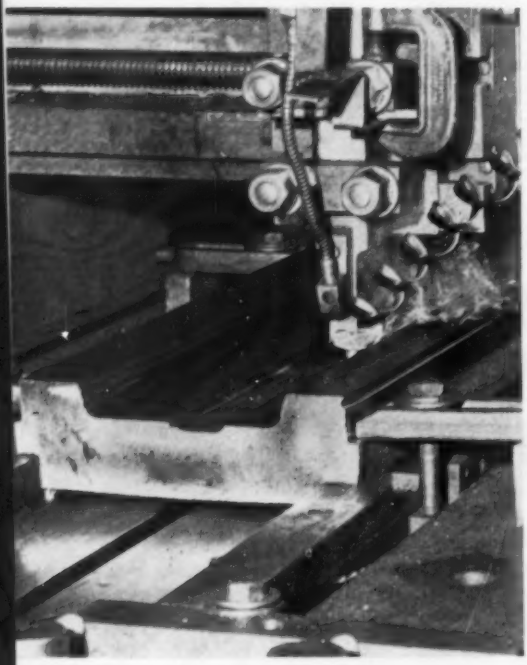

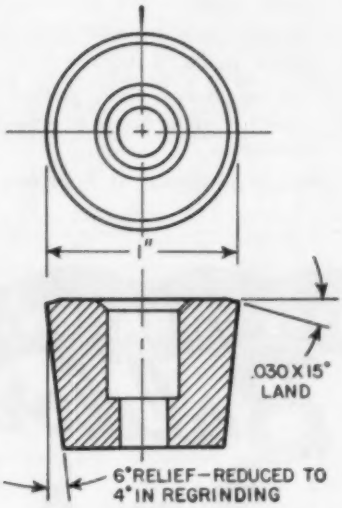

Carbide insert was modified as shown for rough planing operation at left. Used in four indexed positions it removes more than 18,000 cu. in. of steel per grind.

Rough Planing With Carbide Inserts

PHILADELPHIA—The rugged job of rough planing more than 2000 cu. in. of metal out of a solid piece of SAE 1035 steel to make a 113-in. long trough proved so successful recently with a heavy-duty tungsten carbide cutting tool that potential possibilities were found to be beyond the capacity of the planer and its 25-hp. motor.

The operation, which is being performed at the Fischer Machine Company, Philadelphia, on a Rockford planer, has been running for more than eight months with Kendex Style CDH 43 inserts, Grade K21, supplied by Kennametal Inc., Latrobe, Pa. With these inserts it was found possible to increase the feed to 0.07 in. in increments of 0.01 in. per stroke with a 0.25-inch depth of cut, but owing to machine vibration and overload on the motor the feed was backed off to 0.032 inch. Running speed is 200 SFM with 10 strokes per minute. A Milford Atom-Lube mist coolant system with 80 lb. of air and 20-1 Cimcool was used.

A single Kendex insert removes a

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Where products must be tough . . . must stand up under vibration, shock and abuse . . . designers specify rugged, reliable, precision-built FLEXLOC self-locking nuts as fasteners.

Here's why: FLEXLOC locknuts are strong: tensile strengths far exceed accepted standards. They are uniform: carefully manufactured to assure accurate, lasting spring tension in the flexible locking collars. And they are reusable: rough screw threads, repeated removal and replacement, frequent adjustments will not affect their locking life.

Standard FLEXLOC self-locking locknuts are available in a wide range of standard sizes and materials, to meet the most critical locknut requirements. Your authorized industrial distributor stocks them. Write us for complete catalog and technical data. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 52, Pa.

STANDARD PRESSED STEEL CO.

FLEXLOC® LOCKNUT DIVISION **SPS**

JENKINTOWN PENNSYLVANIA

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total of 183,000 cu. in. of steel from 80 pieces (3½ x 10 x 113 in.) with nine regrinds. Each trough is 3 in. deep, 6¾ in. wide, and 113 in. long, leaving a channel with ½-in. web and 1⅜-in. thick flanges, and less than half the original weight of the bar.

Inspection of the round insert after the first two pieces were planed disclosed only about .010-in. top crater. The insert was then indexed or rotated to a new cutting edge. It is used in four positions 90 deg. apart to plane eight pieces before regrinding. The insert is reconditioned by grinding on the top surface and on the circumference. The original 6-deg. relief is reduced to 4 deg. during regrinding, as shown in the line drawing. A .030 x 15-deg. land is put on the cutting edge for this job.

Clearing Series-S straight side presses give you the capacity and rigid construction for all types of drawing and heavy blanking operations, the precision that's required for progressive die work and lamination production. All the facts on these moderate priced, versatile machines are given in a colorful new 48 page catalog—complete specifications and full, accurate descriptions of construction and features. Write for it today.

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CLEARING MACHINE CORPORATION *Div. of U.S. Industries, Inc.*
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as applied to
Bridgeport
TURRET MILLING MACHINES
is no accident

Your nearest dealer will gladly furnish full information . . . or contact us direct.

And the reason for this universally descriptive term applied to "BRIDGEPORT MILLERS" is simply and briefly because, from base to turret, they are designed and built with "greatest value" the objective in their specifications.

For example, precision is of highest order and components are held to closest tolerance to achieve this objective.

Then, too, with the "BRIDGEPORT", versatility contributes to "value" in that with these machines, milling, drilling, boring and shaping are operations handled at all angles of the work without changing set-up. And with the recently available True Trace Hydraulic Duplicator attachment, the "BRIDGEPORT" offers excellent performance and outstanding savings in time in copying such parts as irregular dies and moulds.

All these features have been tried and proved in day-to-day service in literally thousands of shops, large and small, because the "BRIDGEPORT" is within the reach of any and all shops who know "value" and modernize accordingly . . . with "BRIDGEPORTS."

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

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The ordinary fasteners securing the worm wheel to the drum shaft in this screw machine loosened, causing $120 worth of damage. Labor for the repair cost $100. The fasteners were replaced with self-locking UNBRAKOS, which eliminated the trouble.

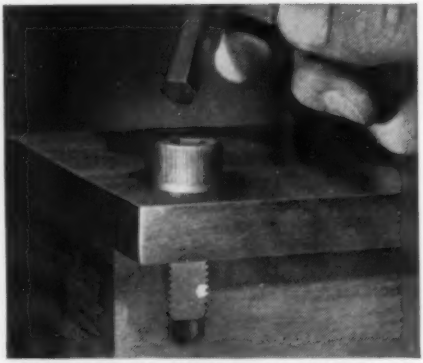
Vibration won't loosen self-locking UNBRAKO socket cap screws

UNBRAKO socket screws with the Nylok* self-locking device eliminate fastener problems caused by vibration.

Take the drive system in the automatic screw machine illustrated above, for example. The screws originally used to secure the worm wheel to the drum shaft loosened, causing considerable damage, besides loss of production time. These have now been replaced with self-locking UNBRAKO socket head cap screws and the trouble has been eliminated.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or endless running of a machine won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives catalog and technical data on the complete line of UNBRAKO socket screws with the Nylok self-locking device. Or see your local industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 52, Pa.



HOW IT LOCKS. The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together and locks the screw securely—whether or not the screw is seated.

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION

SPS

Jenkintown Pennsylvania

*T.M. REG. U.S. PAT. OFF., THE NYLOK CORP.

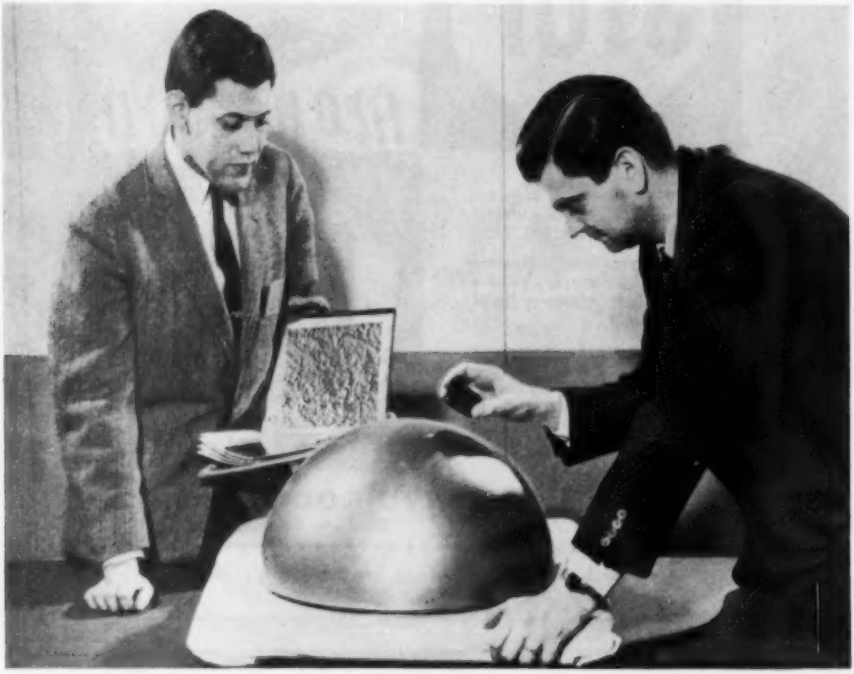
Use postpaid card. Circle No. 331

B & L Pioneers in Super-Finishing of Metals

Engineers at the Bausch & Lomb Optical Co., Rochester, N.Y., have succeeded in producing on stainless steel hemispheres surfaces accurate to between 4 to 6 micro-inches (4 to 6 millionths of an inch). Need for the super-finishing process grew out of the requirements of super-sonic aircraft and missile research programs.

The company has developed techniques which permit the super-finishing of hard metals of spherical, parabolic and elliptical shapes up to 36" in diameter. Experimentation on larger surfaces of other shapes is now underway.

Stimulating the firm's original interest in the new field was a request by



Harry H. Herman, Jr., left, and John F. Richards, staff members of Avco's research and advanced development division, view one of the 19-inch stainless steel hemispheres which were super-finished by Bausch & Lomb for use as research tools in tests at the National Advisory Committee for Aeronautics supersonic wind tunnel in California.

the research and advanced development div. of Avco Mfg. Corp., Lawrence, Mass.

Avco engineers needed test samples for determining the air flow patterns of high velocity winds against different metal surfaces.

After reaching a tentative agreement to undertake the task, Bausch & Lomb received from Avco six 19-inch hemispheres of rough-spun 400 series steel. Different surface specifications, ranging from 4 to 6 micro-inches to 180 micro-inches were established for each hemisphere.

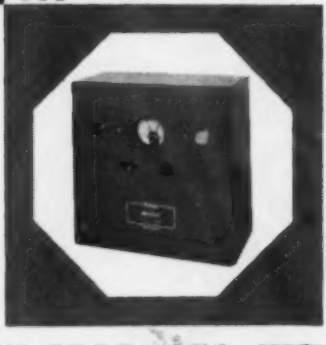
Utilizing methods developed for the grinding and polishing of reflectors for Army and Navy searchlights and motion picture projectors, the company's engineers were able to meet the Avco surface specifications.

K. E. Reynolds, head of the optical

damage to machinery with automatic protection...

Sperry

monitron



Stop damage from pile-ups, misfeeds, dull tools, oversize stock, faulty lubrication, etc.

Monitron senses load increase or decrease, stops motor, releases clutch, applies brake — before damage is done.

Monitron protects electrically driven presses, dieing machines, conveyors, pumps, automatic machine tools. Send coupon for full information.

Sperry

SPERRY PRODUCTS, INC.
Danbury, Conn.

Please send me complete data on the Sperry Monitron.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Use postpaid card. Circle No. 332

firm's photographic and defense products sales department, emphasizes the fact that the B&L work is still in the experimental stage.

"We're not yet certain ourselves of the full implication of this application of optical principles to the surfacing of metals," he says. "However, experiments like the one presented to us by Avco lead us to believe that this new technique will ultimately permit the production of even finer surfaces of volume."

Ryerson Steel to enlarge Pittsburgh plant

Joseph T. Ryerson & Son, Inc. has announced an expansion program at its Pittsburgh, Pa. steel service plant which will increase capacity more than one-

New B & W ADAPTERS for Flat Form Drills

Fit all B & S Screw Machine Holders

Your satisfaction guaranteed on form cutters made for non-ferrous applications.

Do More Work with Less Tooling

Cut your costs with B&W flat form drills and step cutters with this new adapter — they're

Tested and Proven

Use them in floating and other types of holders. Positive lock, blades are easily and quickly changed without changing setup.

Small Investment Pays Big Returns

Streamline your automatic screw machine production with B&W Flat Step Drills and this new Adapter!

Send for literature and prices.

Shipped from stock for all B&S Holders

B & W PRECISION PRODUCTS CO.

11393 E. Eight Mile Rd., P.O. Box 3865, Detroit 5, Mich.

Engineering Dept. W

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third. Charles L. Hardy, president, said that construction would begin this year with completion in 1958. Cost of the building, machinery, and other operating equipment is estimated at approximately $1,000,000.

The addition will consist of a crane served span 110 ft. x 480 ft., which will be erected adjoining the present building. The new space will be used principally for larger and more diversified stocks of structural, plate, reinforcing bar, and sheet steel. A 15-ton, two-hoist bridge crane will be installed, along with new cutting and other steel handling equipment.

Crucible Steel opens St. Louis warehouse

On May 16, Crucible Steel Co. of America formally opened its new specialty steel warehouse at 8610 Page

WILSON "ROCKWELL"—
THE WORLD'S STANDARD OF HARDNESS TESTING ACCURACY

WILSON "ROCKWELL"
DIAMOND

"BRALE" PENETRATORS

A FULL WILSON LINE
TO MEET EVERY HARDNESS
TESTING REQUIREMENT

FULLY AUTOMATIC
•
SEMI-AUTOMATIC
•
REGULAR
•
SPECIAL
•
SUPERFICIAL
•
TUKON MICRO & MACRO
HARDNESS TESTERS

With WILSON Diamond "BRALE" Penetrators the accuracy built into your "ROCKWELL" hardness tester is not jeopardized. Thus, there is no danger of your rejecting good parts, passing sub-standard parts or endangering your good name with your customers. Inaccurate measurements with less expensive, inferior quality diamond penetrators are a hazard you cannot afford.

WILSON "ROCKWELL" Hardness testers—with WILSON Diamond "BRALE" Penetrators, carefully selected and scientifically ground with painstaking accuracy, combine to insure perfect Rockwell hardness testing every time.

ACCO
for Better
Values

Wilson Mechanical Instrument Division
AMERICAN CHAIN & CABLE

ACCO

230-T Park Avenue, New York 17, N. Y.

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Blvd., St. Louis, Mo., by playing host to over 400 businessmen and industrialists.

The new facility, built on 3½ acres, has 33,600 sq. ft. of warehouse space with a 5250 sq. ft. sales office attached. It replaces the former warehouse located in downtown St. Louis.

J. J. Wycall, Crucible's new St. Louis branch manager, and **K. C. Kelly**, former manager and at present southern regional sales manager, greeted visitors and escorted them around the plant.

Officials from the company's executive and product offices who attended the opening were: **Joel Hunter**, president; **J. S. Billingsley**, assistant to vice president, sales; **George W. Stamm**, general sales manager; **R. M. Simpson**, asst. general sales manager, field; **G. W.**

HOLD IT!

FIRMLY BUT GENTLY

WITH WOODWORTH CHUCKING EQUIPMENT

Our tough looking character who is holding the smiling baby clearly demonstrates one fact: whenever you are holding *anything* it should be secured with gentle firmness. And this is so true when considering chucking equipment.

Your best machine will produce only as accurately as its work-holding device permits and Woodworth manufactures the most rugged, accurate and dependable chucks for precision machining in America.

We invite your inspection and consideration of N. A. Woodworth products. There is a Woodworth Sales Representative in your area and a letter to the N. A. Woodworth Company will place him promptly at your service.

WOODWORTH
1300 EAST NINE MILE ROAD
DETROIT 20, MICHIGAN

Use postpaid card. Circle No. 335

Snyder, asst. gen. sales manager, product div.; **F. L. Cooper,** treas.; **H. Whelan,** manager, warehousing; **Michael Stumm,** advertising and promotion manager; **R. C. Jordan,** product mgr., cold rolled div.; **W. H. McCormick,** product mgr., Park alloy & carbon div.; **W. B. Downes,** product mgr., stainless div.; **F. J. Coates,** sales mgr., Vacuum Metals Corp.; **K. A. Matticks,** central metallurgical office; **J. A. Ross,** Pittsburgh crucible div.

National Acme enlarges main office

Construction to total $250,000 in enlarged and modernized office facilities was started by The National Acme on April 29. When completed in October, nine thousand sq. ft. of new area will have been added to the main office. The addition will take the form of a two-story plus basement section having three 29 x 112 ft. floor areas.

quadrill

4 Position Drilling and Tapping

TURRET HEAD

Does the work of 4 drill presses

DRILLS • REAMS
COUNTERSINKS
COUNTERBORES

The quadrill performs all these operations without setting up each time. Any of four cutting tools can be brought into drilling position by indexing the turret. A real time and cost saver!

FITS ALMOST ANY DRILL PRESS

TAP with the quadtapper

By attaching the QUAD-TAPPER to any of the four spindle assemblies of the QUADRILL, you can drill and tap almost simultaneously. Affords accurate tapping at high speeds.

DESIGNED FOR PRODUCTION COST CUTTING

Send for complete details of both QUADRILL and QUAD-TAPPER construction and operation features.

CHICAGO QUADRILL *Company*

1846 BUSSE HIGHWAY • DES PLAINES, ILL.

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The Schauer Mfg. Corp., Cincinnati, recently celebrated the 50th anniversary of the founding of the firm. J. K. Wilson, manager of industrial sales (left), and A. J. Kohn, president, are shown examining the latest small type of the Schauer Speed Lathe.

NOW . . . on a low cost Do-It-Yourself basis YOU CAN QUICKLY INSTALL THESE MACHINES

ON Air-Loc® MOUNTS . . . .

You just keep sheets (18" x 36") of AIR-LOC on hand and cut your own mounts with a saw. Result: Your machines are easy to shim on AIR-LOC and once leveled, they *stay level.* Vibration and noise are reduced. Your mounts are impervious to oil, water, etc.

PRESSES
LATHES
GRINDERS
SHAPERS
PLANERS
DRILLS
THREADERS
etc., etc.

● precision level (to .0005") can be maintained as AIR-LOC resists static pressure

Air-Loc® gives you the advantages of precision installation—without using expensive or complicated mounts.

Write for samples and installation instructions.

AIR-LOC is made by:
CLARK, CUTLER, McDERMOTT CO.
Franklin, Massachusetts

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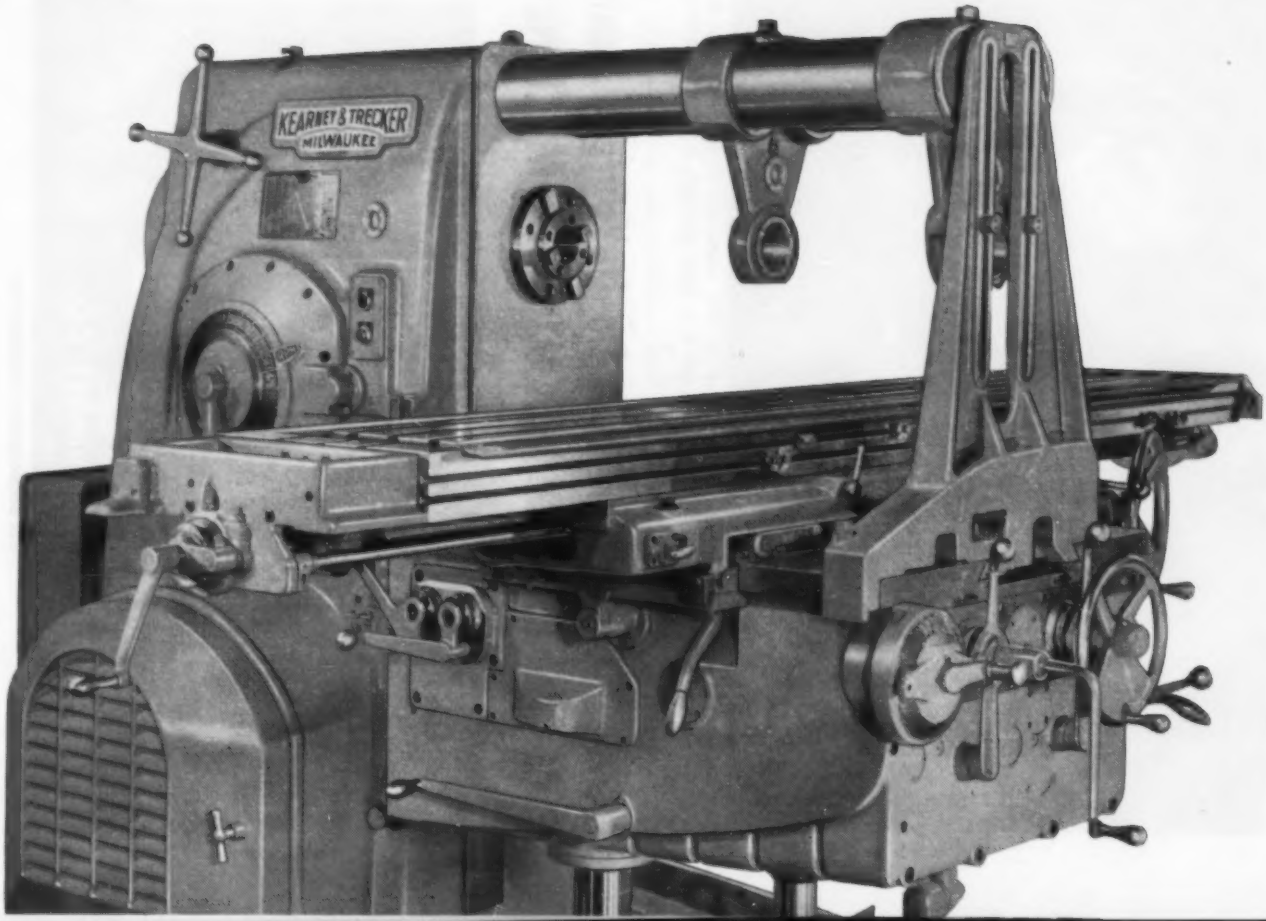
KEARNEY & TRECKER
MILWAUKEE

On all TF series

heavy-duty, knee-type milling machines!

Exclusive

KEARNEY & TRECKER MILWAUKEE **twin elevating screws**

INCREASE ACCURACY 3 TIMES

over single screw designs

KEARNEY & TRECKER MILWAUKEE

Designers and Builders of Precision and Production Machine Tools Since 1898

Want Proof?

We'd like to show you. Write for BulletinTF-57 on your letterhead.
KEARNEY & TRECKER CORP.,
6796 W. National Ave.,
Milwaukee 14, Wis.

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Investments in plants, tools spur Canada's output

Canada's record investments in new plants and machinery are boosting its gross national product at a rapid rate, James C. Kelley, general manager of the American Machine Tool Distributors' Association, told a meeting of the Canadian Machine Tool Dealers Association recently. He pointed out that Canada's private business expenditures for construction and productive machinery during 1956 rose 34 per cent over 1955, as compared with a 1956 increase of 21 per cent over 1955 for new plants and facilities in the U.S.

"As a direct result of this vigorous expansion," Kelly said, "Canada's industrial production in 1956 rose 7 per cent over 1955 and the Dominion's total output of goods and services in 1956 increased 11 per cent over 1955, or double the 5½ per cent increase in

YOUR CHOICE
FOR THE FINEST ★
In high speed steel
TOOL BITS!

VASCO SUPREME

★ Higher Hardness
★ Higher Hot Hardness
★ Higher Wear Resistance
★ Higher Cutting Efficiency
—THAN ANY OTHER HIGH SPEED STEEL

For every job involving wear or high cutting temperatures, Vasco Supreme Tool Bits cut faster and longer—make profits for you! *Prove it* on heat treated steels, hard cast iron, aluminum, brass, plastics. Available in squares and flats from stock. Write for Vasco Supreme folder and Data Sheet.

VANADIUM-ALLOYS STEEL CO.
LATROBE, PA.
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U.S. gross national product for the comparable years."

Only about 20 per cent of the Dominion's exports to the United States are now classified as raw materials, Kelley pointed out, as against 36 per cent in 1949.

Open house at Sunnen Products

Two booklets covering the history of the Sunnen Products Co., from its humble beginning in a 4-car garage to its present greatness, were distributed as souvenirs at a "Family Night" celebration the evening of May 7, commemorating the 30th anniversary of the incorporation of the company.

Features of the open house included tours of both Sunnen plants, demonstrations of industrial honing and automotive rebuilding equipment, numerous displays, followed by refreshments for all.

how to trap dust

that damages your machines and hurts company morale

Easy-to-move

TORIT

dust collectors trap dust at its source!

Untrapped dust costs money: "secretly" forces precision machines out of line, limits production. Torit dust collectors are unitized for custom installation—save more money, usually more efficient than central (built-into-building) system. Torit unit operates only when machine or combination of machines it protects are on. Filtered air may be returned to room to save heat. Many models and sizes, all self-contained, easy to move. Write today to . . .

TORIT manufacturing co.

Dept. 601, 311 Walnut Street, St. Paul 2, Minn.

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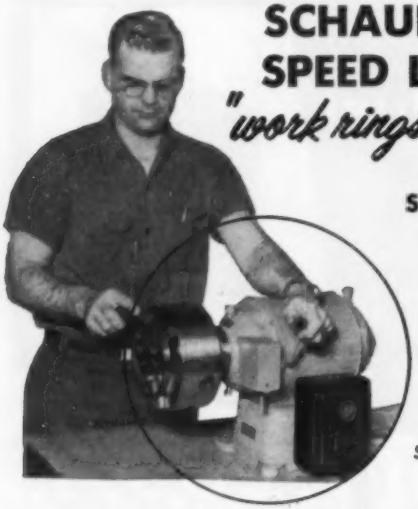
New building for Natco

A new 75 by 530 foot building has been added to the main plant of the National Automatic Tool Co., Inc., at Richmond, Ind. This addition increases manufacturing space by 30 per cent. It provides more assembly area and makes possible more rapid shipment of finished products.

This latest step in Natco's plant expansion program brings the firm's floor space to a total of 342,000 square feet and also makes room for newly purchased production equipment. Two cranes provide up to 30 ton capacity with an electronic crane scale.

Dake builds new plant

The Dake Corp. has constructed a new plant at 724 Robbins Rd., Grand Haven Township, at a cost of more than $500,000. The building, 250 ft. long and



SCHAUER SPEED LATHES

"work rings around"

OTHER SECONDARY FINISHING METHODS

Stoning hardened steel ring with Schauer Type NA2B Speed Lathe.

These versatile, low-cost machines provide the fastest, most economical method of filing, deburring, polishing or lapping metal and plastic parts. There's a Schauer Speed Lathe to solve practically any secondary finishing problem. Many sizes and models with holding devices to suit the job. *Speed your production* with Schauer Speed Lathes. Write for Catalog No. 530.

OUR 50TH YEAR

SCHAUER MANUFACTURING CORP.

4502 Alpine Ave. • Cincinnati 36, Ohio

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180 ft. wide, includes three 60-ft. bays. The central bay is 42 ft. high and the other two 22 ft. high, giving ample clearance for moving materials with cranes.

There are 45,000 sq. ft. of shop space and 5600 sq. ft. of office space. The plant is built on a 10-acre site.

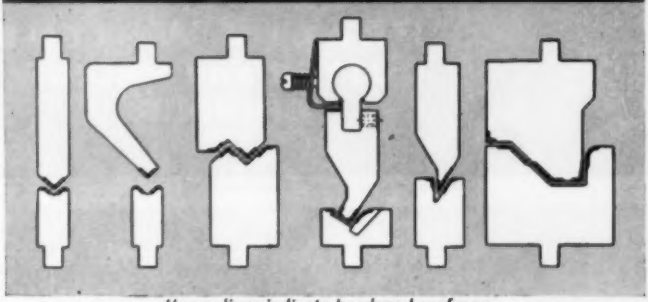
New company formed

Clinton J. Helton, formerly with the Union Supply Co., Denver, Colo., has now formed his own company, known as Clint Helton and Co., located at 142 Broadway, Denver. The new firm will sell machine tools, industrial cutting tools, and electronic, optical and mechanical inspection equipment.

Sterling Die completes expansion program

A major expansion program, including a move of facilities to a new plant

CHICAGO INDUCTION HARDENED PRESS BRAKE DIES



Heavy lines indicate hardened surfaces

for greater die life—
at no extra cost—
on any make press brake

Whether it is a simple die for angle bending or the more complex dies for any of the combined bending and forming operations, CHICAGO induction-hardened dies offer bonus performance at no extra cost. Field reports on these dies show better than ten times the useful life of the conventional dies used in press brakes. Get the full particulars on CHICAGO induction-hardened dies for your next press brake job.

Steel Bending Brakes For Over Fifty Years 4901

DREIS & KRUMP MANUFACTURING COMPANY
CHICAGO STEEL BENDING BRAKES BOX AND PAN BRAKES PRESS BRAKES
7440 S. LOOMIS BLVD., CHICAGO 36, ILL.
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GRINDS
THEM ALL!
Radii, angles or tangents . . . straight or tapered flutes . . . square, radius or ball ends . . . this machine grinds practically any special or standard cutting tool quickly, accurately, economically. Learn how you can reduce tool costs, improve work quality, cut machining time – write for Circular No. S455-8.
PRATT & WHITNEY
CUTTER and RADIUS
GRINDER

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in the Southwest Industrial Park section of Cleveland, has been completed by the Sterling Die division of the Pratt & Whitney Co. Inc. An open house was held April 30 for their customers.

The new plant triples manufacturing facilities. It houses both administrative offices and manufacturing operations.

P & W Expands Rochester Branch

Pratt & Whitney Co. Inc., West Hartford, Conn., has expanded its Rochester, N.Y., branch office facilities. Modern, enlarged quarters in the Linden Industrial Park area of Rochester increase by 100 percent the sq. ft. area of the branch's former location. A new grinding and tool sharpening service will be established at the new plant.

Maserati Expands Facilities

The Maserati Corp. of America has moved to new and larger quarters at 46 Sea Cliff Ave., Glen Cove, L.I. in order to accommodate an increased stock of machine tool equipment, parts and demonstration units.

The modern, air conditioned building will house the complete line of machine tools and parts imported by the company, with facilities for testing and demonstrating under actual operating conditions.

Producto opens new die set warehouse

A new die set assembly warehouse was opened by the Producto Corp. on

KELLER CUTTERS . . .
FOR TRACER-CONTROLLED MILLING

COST LESS IN THE LONG RUN, because they run longer, produce more accurately finished pieces per tool than cutters costing less initially. Ball, radius and square nose; straight and taper shank types in a complete range of sizes are available from stock at the P&W Branch Office near you. Write for complete information. Pratt & Whitney Company, Inc. 22 Charter Oak Blvd., West Hartford, Conn.

PRATT & WHITNEY
FIRST CHOICE FOR ACCURACY
MACHINE TOOLS • GAGES • CUTTING TOOLS

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P&W
210,000
HOLES...
and still running!
A satisfied user reports 120,000 pieces before the first grind . . . 90,000 after grinding . . . and still producing accurately threaded holes! Performance like this is possible because P&W Taps are always accurate, always concentric with shanks, threads, OD's and chamfers . . . all ground on centers.
PRATT & WHITNEY TAPS
A COMPLETE RANGE OF SIZES AVAILABLE
FROM STOCK AT THE P&W OFFICE NEAR YOU.

Use postpaid card. Circle No. 345

June 1 at 13620 Enterprise Ave., Cleveland, O. Heading the staff of factory-trained personnel is Manager Charles W. Scheihing, who has been with Producto for 11 years.

Obituaries

Joseph Armitage

Joseph B. Armitage, 76, consultant-vice-president for Kearney & Trecker since 1955, died May 30.

Mr. Armitage joined the Milwaukee company in 1920 as chief engineer and held this position until 1943 when he was elected vice-president in charge of engineering. During his 37 years at Kearney & Trecker, he was credited with 121 patents in the machine tool field.

It is requested that floral expressions of sympathy be omitted in favor of memorial contributions directed to ASME Old Guard Fund supporting engineering scholarships, 29 W. 39th St., New York, N.Y.

Charles C. Cheyney

Charles C. Cheyney, 68, vice-president in charge of sales for the Buffalo Forge Co. since 1953, died April 25 at Syracuse, N.Y. He suffered a heart attack while on a business trip.

Mr. Cheyney joined Buffalo Forge as a sales engineer in 1911. He became assistant sales manager in 1928, sales manager in 1945, and was elected a director of the company in 1949.

Wendell E. Whipp

Wendell E. Whipp, 73, chairman of the board of the Monarch Machine Tool Company, Sidney, O., was drowned April 27, when the boat from which he was fishing overturned on the lake adjoining the Monarch Rod and Gun Club.

Appointments and Promotions

Changes in Executive and Production Personnel

Name	Company	To	Position
Paul L. Lantz	Norton Co. Worcester, Mass.	Abrasive Division	Production Manager
Preston D. Liebig	Curtiss-Wright Corp. Caldwell, N.J.	J & S Tool Co., Inc. Livingston, N.J.	Chief Engineer
O. A. Ahlers	Sheffield Corp. Dayton 1, O.	Machine Tool, Contract Mfg., Threadwell-Conway Tap and Die Divisions	Manager
Henry A. Arnold	Olin Mathieson Chemical Corp. New York, N.Y.	Olin Mathieson International Corp.	President
Alfred J. Sherman	Monarch Machine Tool Co. Sidney, O.	Same	Vice Pres., Mfg.

Paul L. Lantz

Preston D. Liebig

Henry A. Arnold

Alfred J. Sherman

Check Class 3 and 3A Threads

...DEPENDABLY, ECONOMICALLY

The P&W Tri-Roll Thread Comparator, using full-length rolls, provides a *complete functional check* . . . detects errors in lead, angle, pitch diameter and in deviation from true helical path ("drunken lead"). With interchangeable single-rib rolls, the same comparator provides a *critical check* of pitch diameter . . . duplicating, for the first time in a production gage, the highly precise 3-wire measurement method. Write for complete information. Pratt & Whitney Company, Incorporated, 22 Charter Oak Blvd., West Hartford, Conn.

FUNCTIONAL CHECK CRITICAL CHECK OF P. D.

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

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Changes in Executive and Production Personnel

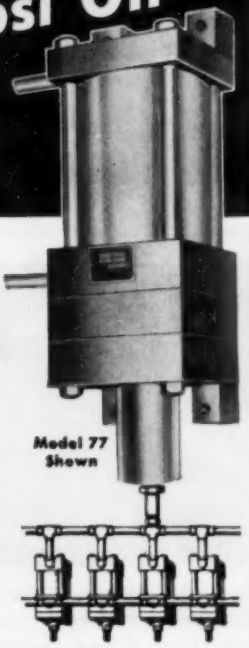
Name	Company	To	Position
W. Fay Aller	Sheffield Corp. Dayton, O.	Autometrology, Standard Production Instr., Fixed Gage and Inspection Inst. Divisions	Vice President
William I. Wilt	Sheffield Corp. Dayton 1, O.	Standard Prod. Instr. Div.	Asst. Vice Pres.
Dr. Robert F. Rea	Carborundum Co. Latrobe, Pa.	Diamonite Products Mfg. Co. Canton, O.	Director of Engin.
John C. Miller	Skidmore Gear Co. Cleveland, O.	Same	Exec. Vice Pres., Director
Elmore L. Andrews	Thompson-Hines & Flory	Monarch Machine Tool Co. Sidney, Ohio	Director

TRU-O-SEAL
TEFLON SEAL
STOPS PIPE THREAD LEAKS
PAT. PENDING
Satisfaction Guaranteed Or Money Back TRIAL OFFER
TRU-O-SEAL Fittings are guaranteed to seal pipe thread connections permanently against all oils, practically all known chemicals and gases; to seal under high pressures or vacuum; to withstand —280° to plus 500° F.; to eliminate "overtightening" damage and pipe dope. Available in ⅛" to 2½" pipe thread sizes.
$10.00 Trial Offer No. 1: eight ⅛", ten ¼", eight ⅜", ten ½" pipe thread TRU-O-SEAL Fittings.
$10.00 Trial Offer No. 2: eight ½", ten ¾", four 1" pipe thread TRU-O-SEAL Fittings.
Send order to
TRU-O-SEAL DIVISION
Flick Reedy Corporation
2026 N. Hawthorne. Melrose Park, Ill.
"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.
1
Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
2
Thread pipe or fitting 4 threads into port. Point in desired direction.
Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).
Use postpaid card. Circle No. 347

Changes in Executive and Production Personnel

Name	Company	To	Position
Frank J. Graziano	Monarch Machine Tool Co. Sidney, O.	Same	Secretary
Robert M. Peters	Monarch Machine Tool Co. Sidney, O.	Same	Asst. Treas.
Walter O. Faulkner	Monarch Machine Tool Co. Sidney, O.	Same	Asst. Secy.
John V. Eakin	Fawick Corp. Cleveland, O.	Same	Vice President
Jerome A. Raterman	Monarch Machine Tool Co. Sidney, O.	Same	Chairman of Board
Fred C. Dull	Monarch Machine Tool Co. Sidney, O.	Same	Vice Pres.-Treas.

Up To
10,000 psi Oil
from
Shop Air!



Miller AIR TO HYDRAULIC
BOOSTERS

No Pumps or High Pressure Valving Needed

Hook a Miller Air-Hydraulic Booster to your air line and get INTENSIFIED (ratios up to 100 to 1) Hydraulic Power that you can vary and control at will and use for such common shop operations as punching, clamping, pressing, riveting, shearing, welding, crimping, testing, etc. High pressure booster output drives the hydraulic work cylinders and can be directly applied (without cylinders) in testing, measuring, other applications. Boosters save air, space, weight, require little or no maintenance, and hold pressure as long as desired without additional power consumption. Models for immediate delivery.

Model 77 Shown

Write For Full Details

Miller FLUID POWER DIVISION
Flick Reedy Corp.
2026 N. Hawthorne • Melrose Park, Ill.

Changes in Executive and Production Personnel

Name	Company	To	Position
Frank I. O'Leary	Monarch Machine Tool Co. Sidney, O.	Same	Vice Pres., Industrial Relations
Robert M. Zimmerman	Lipe-Rollway Corp. Syracuse, N.Y.	Same	General Manager
Joseph C. Henderson	John Wood Co. Conshohocken, Pa.	Has retired from his position as Supervisor of Purchases	

Changes in Sales and Service Personnel

Name	Company	To	Position
Mrs. Dorothy Ford	Pivot Punch and Die Corp. North Tonawanda, N.Y.	Same	New York State Representative
James E. Burke	Joseph T. Ryerson & Son, Inc., Chicago, Ill.	Pittsburgh Plant	Mgr. Alloy, Stainless Steel Sales

Frank I. O'Leary

R. M. Zimmerman

J. C. Henderson

James E. Burke

Made in the following sizes for square tool bits:

3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", and 3/4" square

Novi Square Slotted Sleeves Reduce Tooling Costs

Novi square slotted sleeves provide a simple, quick and inexpensive method of making square holes for installing tool bits in boring bars, tool holders and cutting heads. As shown in the illustration, the sleeve is tapped at one end and is furnished complete with back-up screw. It is simply inserted in a reamed or bored hole and is held in place by a small dowel, or it can be soldered or silver brazed. Ideal for making rectangular as well as square holes.

Sleeves inserted in two-step boring bar

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NOVI TOOL & MACHINE CO.

25806 Novi Road Novi, Mich.

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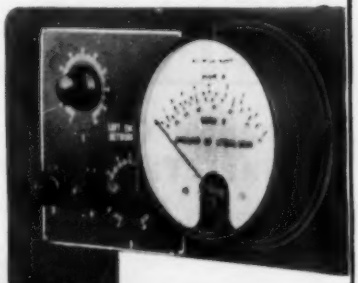
WHITNON
Precision SPINDLES



Rated Double A for Absolute Accuracy!

Absolute dependability and balance is assured by dynamic electronic balancer that checks spindles after assembly — to provide the ultimate in on-the-job perfection.

Whitnon precision Spindles have been developed for new and replacement applications. The extra rigidity from large spring pre-loaded bearings assures constant chatter-free life.

Correct pre-loading mechanisms keep Whitnon Spindles and bearings tight at all times to compensate for changes created by temperature variations and wear.

Whitnon Spindles for Milling and Engraving will increase the output of your machines. Whitnon-held tools cut on all lips, hence tools cut better, faster and last longer . . . producing a finer finish.

Whitnon Spindles are built for high speed and long life. Drills stay sharp and produce a straight and round hole.

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THE Whitnon MANUFACTURING COMPANY
ROUTE 6 AND NEW BRITAIN AVE, FARMINGTON, CONNECTICUT

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Automatic Control Added to Drilling, Tapping Machine

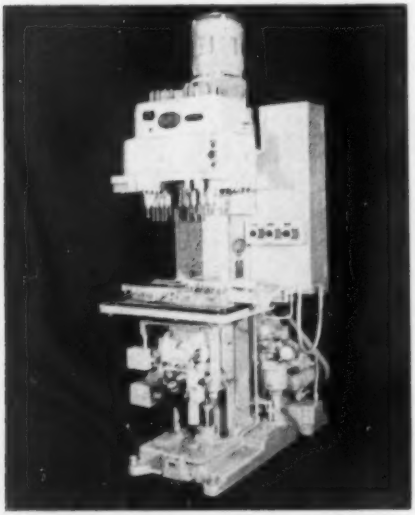
New standard arrangement of the H-6 multiple-spindle drilling and tapping machine offers preset selective cycle control and a straight-line indexing slide. This combination makes automated drilling and tapping practical even for small lot production of a variety of parts usually handled by gang drills. Operator is freed for other duties and setup times are decreased.

In operation the finished part is unloaded, a new one loaded, and starting switch is depressed. The machine then goes through all operations and returns to the loading position.

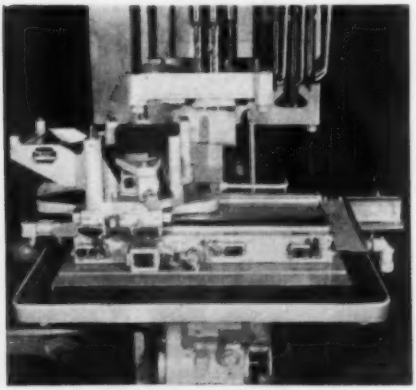
Over one hundred combinations of operations are possible by setting selector dials. Machining functions available include drill, tap, step drill, chamfer, countersink, counterbore, spotface and skip.

Table movement in the drilling cycle consists of rapid traverse up, feed up and rapid traverse down. Tapping cycle: rapid traverse up, feed up, feed down and rapid traverse down. Chamfer cycle (including countersinking, spotfacing, etc.): rapid traverse up, feed up, dwell and rapid traverse down. The table can also be arranged to travel a further distance for drilling than for chamfering operations.

Table feeds are controlled by means of two dials, one for drilling and another for tapping. Taps of different leads can be used by virtue of the vertical float



Natco H-6 equipped with adjustable spindles, 3-position indexing slide and selector switches.



Typical application shows first position used for unloading and loading. Part is drilled in second position and tapped in the third position.

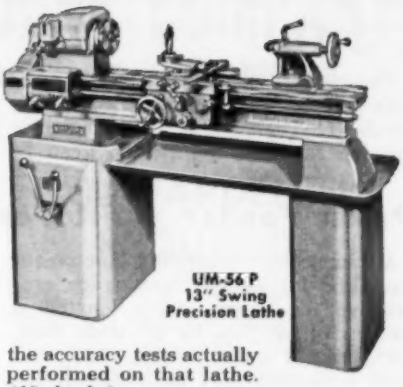
SHELDON Precision LATHES

for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13". . . in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

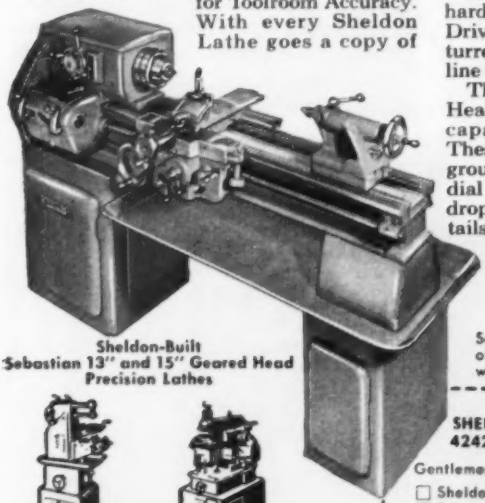
All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).



UM-56 P
13" Swing
Precision Lathe

Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.



Sheldon-Built
Sebastian 13" and 15" Geared Head
Precision Lathes

Send in coupon or write for catalogs and names of nearest Sheldon and Sebastian Distributors where you can see these new lathes in operation.

SHELDON
Horizontal Milling Machine

SHELDON
12" Shaper

SHELDON MACHINE CO., Inc.

Builders of Sheldon Lathes, Milling Machines, Shapers and Sebastian Lathes.

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SHELDON MACHINE CO., INC.
4242 North Knox Avenue, Chicago 41, Illinois

Gentlemen: Please send new catalogs describing:

- ☐ Sheldon ☐ 10", ☐ 11' ☐ 13" Lathes
- ☐ Sebastian 13" and 15' Geared Head Lathes
- ☐ Horizontal Milling Machine ☐ Name of Local Dealer
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Name ..... Title .....

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arrangement built into the spindles.

The hydraulically actuated indexing slide is electrically controlled by means of the selector switches and is available with 2, 3, 4, or 5 positions. Various workholding fixtures can be mounted on the slide.

The basic machine consists of a multiple-spindle geared head and a hydraulic feed table. Spindles are driven through universal joints; they can be arranged with adjustable arms for positioning or can be fixed in the required layout by a slip spindle plate fastened to the head of the machine. Up to 24 spindles can be used on the machine, depending primarily upon horsepower consumed. Spindle drive motor is 3 hp on the standard and 5 hp on the heavy duty machine.

National Automatic Tool Co., Inc., Dept. HS, Richmond, Ind.

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Press Feeder Built For Stock to .125" Thick

Mechanically controlled, automatic feed line for either blanking or progressive die presses feeds lengths as long as 60" of .125" by 60" wide stock. Composed of a coil holder, a decoiling unit, a mechanically controlled feeder unit, and, in cases where a scrap skeleton must be disposed of, a scrap shear, the line is applicable without modification to both progressive die operation and straight blanking work, and is electrically synchronized with the press.

For progressive die stamping, the feeder unit has built-in roll release and anti-back-up rolls. All rolls are driven from a heavy-duty gear transmission through universal-joint coupling bars.

Strip flatness can be controlled by adjusting the built-in roller leveler. A slight up-curl can be rolled in to prevent hanging up of the stock in the dies.

McKay Machine Co., Dept. RH, Youngstown, O.

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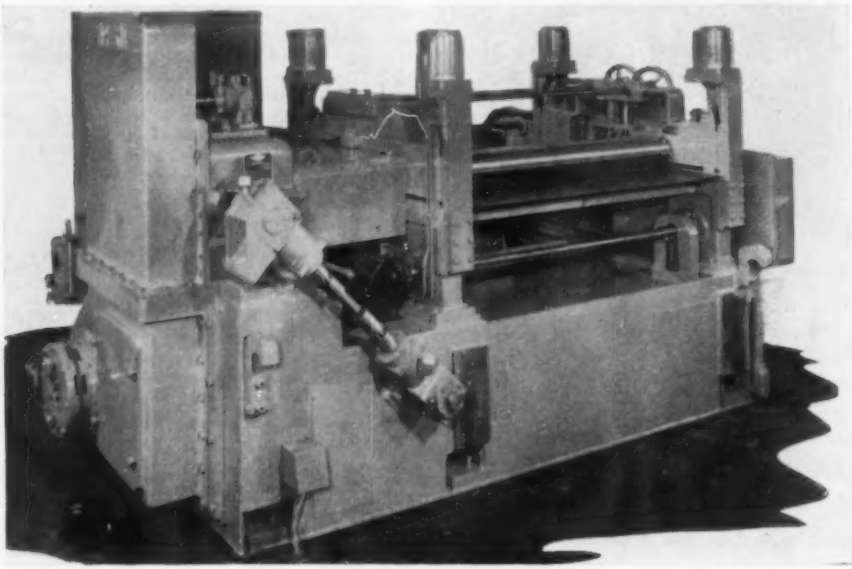

PRODUCTION TOOLING SIMPLIFIED AT EASTMAN KODAK COMPANY

"The Sentry Diamond Block Atmosphere Makes the Difference"

Sentry DIAMOND Block

SENTRY METHOD EASY TO OPERATE

The Sentry Diamond Block Atmosphere is chemically constant and truly neutral, requiring no analysis or regulation. Hence the operator concerns himself solely with tool hardening production.

QUALITY RESULTS EVERY TIME

Sentry Furnaces harden all H. S. Steel tools completely free from scale and decarburization. Ample soak assures full hardness, with sharp edges maintained exactly as before hardening.

QUALITY TOOL HARDENING REQUIRED

Sentry Furnaces have been used at Eastman Kodak for many years to harden all types of special high speed steel for tools, such as the perforators and circular form tool blanks shown at the left.

Quality tools are essential tor economical production of Kodak's precision photographic equipment. Sentry hardening protects quality, thereby promotes economy.

Ask for Catalog P-13

Sentry

TRADEMARK

ELECTRIC FURNACES

THE SENTRY CO.
FOXBORO, MASS.

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Self-cleaning collet

The S-C collet has angular ground surfaces at the end of the collet slits—like fan blades. They repel sludge and chips and prevent foreign matter from entering the collet and mechanism of the machine. Rings and felts are eliminated.

Sheffer Collet Co., Dept. BJ, Traverse City, Mich.

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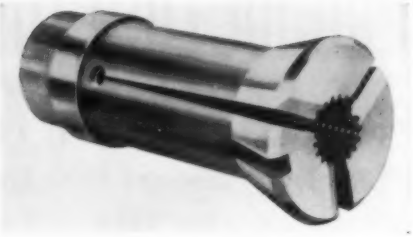
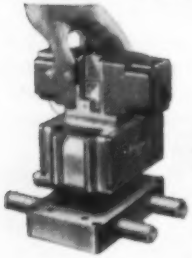


Off 'n On in less than 2 minutes!

another Plus Value



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NOPAK-MATIC valves

LESS MAINTENANCE
FASTER MAINTENANCE

Eliminate costly maintenance and downtime. Entirely new design assures longer, trouble-free operation . . . fast maintenance. Every model is subplate mounted and piping does not have to be disturbed. Loosen four screws and replace a complete unit in minutes. Even "in-the-line" maintenance is shortened with replaceable seats and interchangeable pilot heads.

NOPAK-MATIC valves meet all J.I.C. Standards.

CATALOG 105 describes in detail all of the new and important advantages of Nopak-matic 2-, 3-, and 4-Way valves. Your catalog will be forwarded promptly, upon request.

NOPAK VALVES and CYLINDERS

GALLAND-HENNING NOPAK DIVISION • 2754 S. 31st St., Milwaukee 46, Wis.

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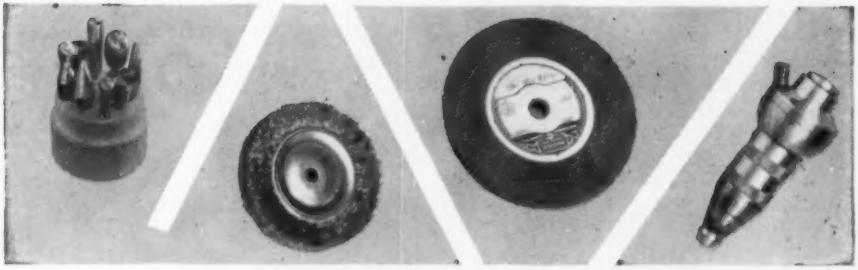

everything you need

from start to finish

Remember, when you're checking specifications and selecting equipment, don't fail to consider Haskins flexible shaft machines and accessories. Haskins' complete line of equipment insures faultless performance on your *special* and *standard* metal-working operations *—without interruptions.*

Whether you're grinding, wire-brushing, filing, whatever the job, a start with Haskins will carry you through from the beginning right down to a perfect finish. Our three models, bench, pedestal and suspended mounts, plus a multiplicity of metal-working tools, enable you to achieve faster production, lower labor costs and a superior finished part! Find out about the versatile line of Haskins flexible shaft machines and accessories—*leaders in their field for over 30 years.*

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HASKINS

R. G. HASKINS Co.

2645 West Harrison Street Chicago 12, Illinois

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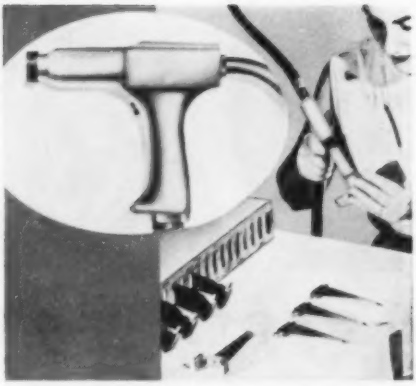
Inspection marking unit

The "Airgrit" permanently reproduces inspectors' symbols, codes, rejects, and designs on machined, glazed or polished surfaces. Products may be marked during continuous production line assembly without interruption to manufacturing operations. When they are too bulky or heavy to be carried to the marking unit, the marking unit is carried to them.

It marks delicate, precision or thin-walled parts without danger of fracture or distortion. It leaves an impression on the surface of the part by blowing fine abrasive grit through the relieved portions of a rubber mask. Mask can be interchanged in a few seconds for different marking by snap-fitting them over the nose of the unit's gun.

Both the depth of marking (settings can be made for marking depth as little as .001") and the marking time



cycle are controlled. Finger pressure on the operating button actuates the complete marking cycle.

Jas. H. Matthews & Co., Dept. RH, 3946 Forbes St., Pittsburgh 13, Pa.

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NOW! LATHE USERS CHANGE TOOLS in a ... FLASH ..

ALORIS QUICK CHANGE TOOL POSTS & HOLDERS

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Only a second to change tools for turning, facing, drilling, boring, threading, knurling, cutting off or any other operation.

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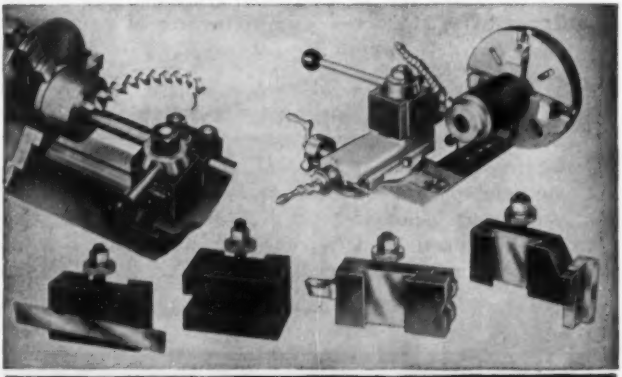

ALORIS TOOL CO., INC. 131-37 SANFORD AVENUE FLUSHING 55, N. Y.

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90 to 3750 r.p.m. The right speed for the job! Controlled by convenient lever on front of cabinet. Precision dial shows selected speed. No belts to change — no tools to bother with!

Put this 1⅛" collet capacity, 9" swing lathe in your shop for the fine, fast and variable work uneconomical on larger machines. Learn how you'll out-produce and under-cost by *writing for Bulletin 918SL.*

RIVETT
LATHE & GRINDER, INC.
MTR 7
Brighton 35, Boston, Mass.

Symbol of Accuracy in Machine Tools

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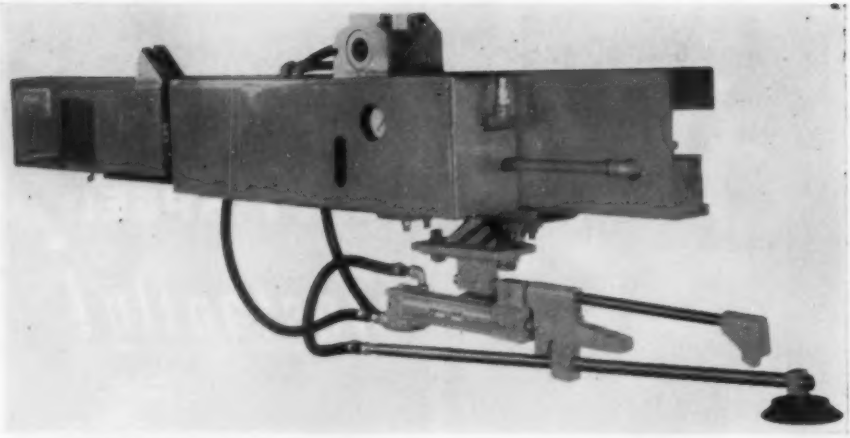
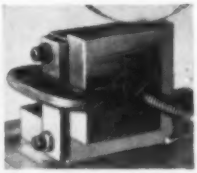


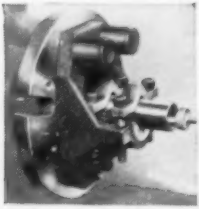
Press Unloader Unit Grips Sheet Metal With Vacuum Cup

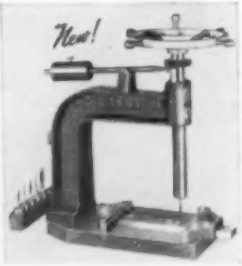
For automatic handling of sheet metal parts in stamping presses, a new gripping mechanism, the Vac-Hand, can be mounted on standard PAS straight-

LASSY TIME SAVING DEVICES

3 STEPS TO SAVINGS!







ANGLE PLATES — WORK HOLDERS — TAPPERS

Exclusive time saving features make them a necessity in every shop—thousands in use. Model R Work Holder illustrated (center). Model P (not shown) with quick acting swing clamp is ideal for production.

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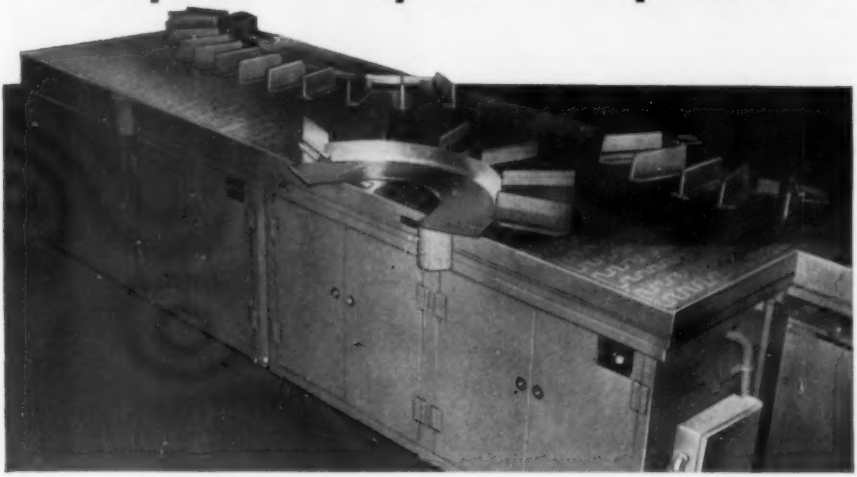

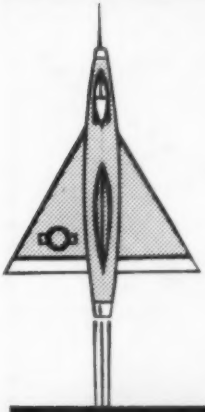

This 36" x 96" magnetic table for the aircraft industry — template, layout and inspection work — timesaving — accurate — cost saving — highly practical unit for small lot work.

Walker engineers design and build holding devices for a wide variety of applications — many special chucks for special work. Put your holding problems up to Walker specialists. They will give you the answer.

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Original Designers and Builders of Magnetic Chucks

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PAS straight-line press unloaders. It has a rubber suction cup on the end of an adjustable rod. Vacuum pressure is induced into the cup for securing a part, and is released to unload the part. The adjustable rod is pivot-mounted and is advanced and retracted by an air cylinder control. The unit operates on 45-psi line pressure.

The flexible rubber cup design avoids marking of panels or moldings. It automatically conforms to both flat and curved surfaces and provides a materials handling unit that will handle a wide variety of part shapes and sizes, thus avoiding the stocking of many different types of jaw assemblies.

Press Automation Systems, Inc., 25418 Ryan Rd., Centerline, Mich.

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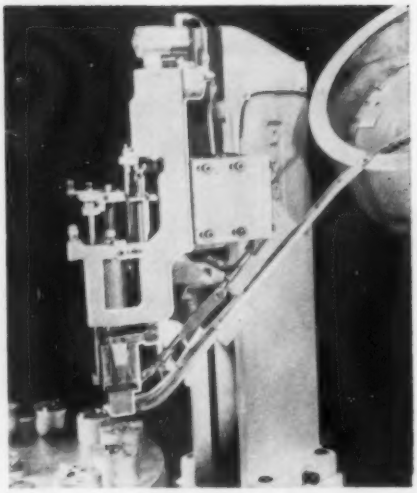


Automatic parts positioner

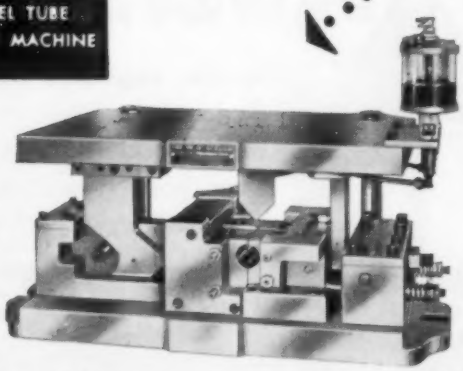
Parts positioner Model PR-3 is a self-contained, standardized unit which automatically handles parts ranging from 1/16" to 3" o.d. at rates up to 7200 per hour. It may be nested on 3" minimum centers along an in-line transfer table or may be located at ad-

Cuts Tubing to Accurate Lengths in SPLIT SECOND TIME!

VOGEL TUBE CUT-OFF MACHINE

LENGTHS of ½ inch or more are accurately cut to ± .010" with each stroke of press—actually less than ⅓ of a second or faster than any other known method. In addition to being rapid and precise, the Vogel Cut-Off also cuts clean with a minimum of burr and distortion. Many thousands of cuts can be made before shear blades require sharpening.

Unit No. 12 accommodates tubing up to ½" O.D. with 3/32" wall; the No. 2 takes tubing up to 2" O.D. with ⅛" wall.



PATENTED

Ask for sample showing how clean-cut your tubing can be sheared with this machine.

VOGEL TOOL AND DIE CORPORATION
1825 NORTH 32nd AVENUE, MELROSE PARK, ILLINOIS

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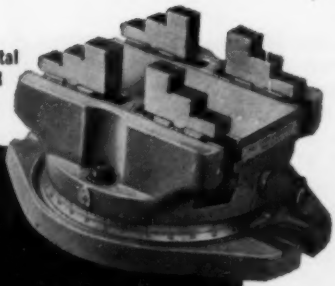
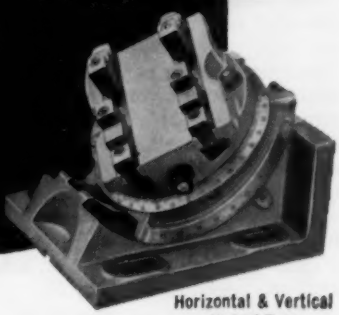
Horizontal Swivel Type



MULTI-PURPOSE WONDER GRIP VISES

4 STEPPED JAWS PERMIT CLAMPING of rough castings, irregularly shaped, round, and tapered pieces accurately and quickly, eliminating need for special jigs or fixtures. Narrow stepped jaws allow free access to and measuring of work pieces and provide clearance for cutting tools. Small work pieces machined on three sides without reclamping. Easy and quick to mount and align on any machine. Holds rigid in any position without vibration. Various capacities and extra soft jaws available.



Horizontal & Vertical Swivel Type

TAPPING ATTACHMENTS

Reversible safety tapping attachments with adjustable graduated friction drive, hardened, ground and lapped, complete with torque bar and handles. Precision made throughout by long established reputable West German factory.

Tested for Performance to High Amer. Standards
Immediate Delivery from N.Y. Stock

MADE IN GERMANY

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jacent stations on a 5" radius dial indexing table having as many as 12 stations.

Normal air operating pressure is 80 lb. Units are available in strokes of 1", 2", 3" or 4" with variable speed up to ½ second per cycle. Base of the ram is engineered for mounting individually designed chuck jaws to suit varied requirements.

For setup purposes, a simple hand-operated pop-up valve is included to initiate the cycle, making it easy to check adjustment and performance without indexing work fixtures or manipulating remote circuit. If a part is missing or improperly placed, the machine stops automatically with ram in forward position, making it a simple matter to find which head failed to perform its proper function.

Dixon Automatic Tool, Inc., Dept. RB, 2300 23rd Ave., Rockford, Ill.

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O ring kit

The No. 1 O ring kit contains 166 rings in 20 different sizes. Developed principally for maintenance use, kit contains sizes from 72701 to 72720 inclusive, each size packed in individual box.

Bearings, Inc., Dept. RH, 3634 Euclid Ave., Cleveland 15, O.

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A JOB THAT ONLY A —
Leitz TOOLMAKER'S MICROSCOPE
CAN DO!

- Permits measurements in 2 dimensions plus checking of Radii, Concentric Circles, threads and angles.
- Has exclusive intermediate image system which combines coordinate measuring microscope and optical comparator in one instrument.
- Built-in charts permit use in three magnifications.
- Reads to .0001" or to .00005" from Master glass scales in larger models.
- Available in 1" x 2", 1" x 4", 2.3" x 6", 6" x 6" and 8" x 40" capacity.

FREE BOOKLET—Write for new catalog.

OPTO-METRIC TOOLS, INC.
137MT VARICK STREET, NEW YORK 13, N. Y.

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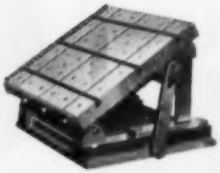
INVEST ONE-TENTH THE COST OF A GOLF BALL . . .

START SAVING DOLLARS IN YOUR TOOLROOM . . . *Now!*

Robbins angular tooling equipment often pays for itself the first few times you use it . . . but let's be conservative. Let's talk about writing off the cost over ten years. (About half the useful life of a "Magna-Sine!") Written off in this manner, the Model A-5 Magna-Sine illustrated represents an investment of around twelve cents a day!

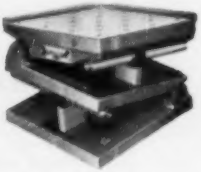
This equipment saves dollars of valuable toolroom time on every job. Set-ups that require *hours* by other methods take just *minutes* the Robbins way. Set up to machine, grind or inspect any angle in just four simple steps: (1) Look up required angle in Table of Constants furnished with unit, (2) Select gage blocks indicated, (3) Place blocks between base and sine bar swivel block, (4) Secure the work . . . and you're ready to go!

This simple, fast, sure method sets up any angle, single or compound, right or left hand, without V-blocks, angle plates or complicated "build-ups." Complete range of models and sizes puts Robbins precision equipment within the reach of every shop. Write now for literature.



HEAVY DUTY SINE PLATE FOR MACHINING

"MAGNA-SINE" WITH MAGNETIC TABLE



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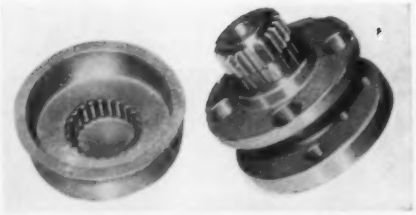
Spline arbor

The Tork-Lok arbor with interchangeable collet for splined parts is used for grinding the o.d. and flanged face true to the pitch diameter of a coupling housing. The collet locates on the pitch diameter of the spline, assuring concentricity of .0005 t.i.r. in the machining of this part.

N. A. Woodworth Co., Dept. BJ, 1300 East Nine Mile Rd., Detroit 20, Mich.



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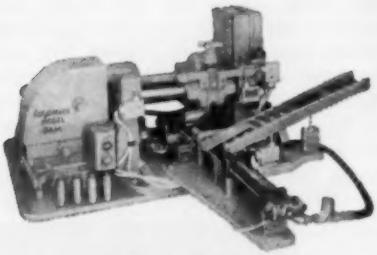
decrees the use of precision automatic machines



ACROJET No. 9AM

The Acromark ACROJET No. 9AM Marking Machine was made for the age of automation. The powerful marking facility is driven by a gear reduction motor. The products or parts to be marked roll down an inclined conveyor, are air-injected into marking position, then air-ejected to the next conveyor or carry-away, after marking. It utilizes the quiet ROTARY principle of marking providing for high production at low cost.

ACROMARK No. 2A

A powerful precision press for name-plate stamping and parts marking semi-automatically or wholly automatically. Furnished complete with slide, chute, dial or other feeds, consecutive numbering heads, marking dies, punches, cut-offs and automatic controls.

This is the equipment used by the leaders—Westinghouse, GE Co., Hoover and many others. All Acromark Machines are original with ACROMARK.

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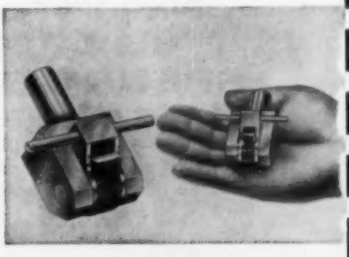
Acromark Heads for Consecutive, Duplicate and Repeat stamping on steel, cast iron, other metals and materials, are precision built for quality and engineered for proper size. Small heads carry small numbers and big heads big numbers.



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THE ACROMARK COMPANY

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Explain your need, send samples of products to be marked or drawings for engineer's recommendation — no charge. Catalog FREE if adaptation is specified. Representatives in most areas.

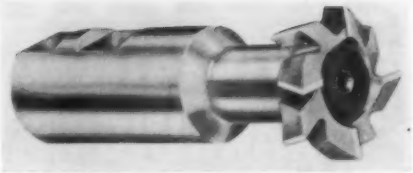
"The Original Marking Specialists"

Circle No. 364 on Card, Opposite Page 65

T-slot cutters

The design of the teeth of these high speed steel T-slot cutters provides ample chip space, and the flutes are ground to give good chip flow and help prevent clogging of the flutes. On request the cutters are furnished with chip breakers ground on the teeth. This aids by further reducing chip size for easier chip disposal.

Stock sizes are from ¼" bolt size to



1½" bolt size. Carbide tipped T-slot cutters are made to order.

Quality Tool Wks., Waukegan, Ill.

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SPERRY BEARING TESTER

The Bearing Tester consists of a metal probe, or pickup, and a compact electronic amplifier. Any malfunctioning in a moving part is transmitted through the probe and shows itself by a change in the noise level and the noise pattern visually presented on the tester's calibrated dial. Lightweight, easily portable, the Sperry Bearing Tester is a positive asset to preventive maintenance, quality control, and receiving inspection.

Bulletin 61-105 describes the Sperry Bearing Tester. Write for your copy.

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STONE

MODEL M-100 Chop-Stroke Cut-Off Machine gives fast, accurate, fully automatic cutting

Cuts any stock . . . in a wide range of shapes, lengths and diameters . . . any material, from aluminum to hardened tool steel. The M-100 will cut it swiftly, cleanly, accurately. Set-ups or resets are easily made. The M-100 cuts at a rate of 2 to 4 seconds per sq. in. cross sectional area . . . up to 5 times faster than comparable power cutting. Exclusive Stone geared-in-head motor delivers maximum power to the cutting edge. Greater speed of cutting produces no change of characteristics nor hardening of material cut.

The M-100 is powered by a 10 H.P. continuous duty, TEFC ball bearing induction type motor. Cuts ferrous metals with an abrasive wheel . . . non-ferrous metals with a saw blade. It comes with fully automatic stock feed and automatic abrasive wheel wear compensator for faster, more accurate cutting without shut-down for adjustment.

The M-100 may be had for manual or semi-automatic operation. For greater power needs, a 15 H.P. motor is available.

WRITE TODAY for complete information on the Model M-100 and other cut-off machines by Stone. 15 Models available in 3½ to 20 H.P. manual, semi or fully automatic operation. Sales and service in principal cities.

". . . represented in every major industry throughout the world."

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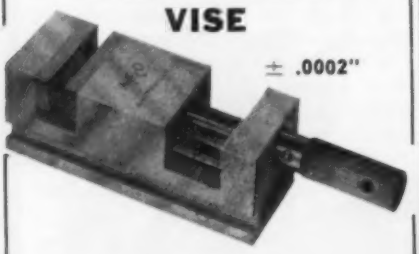

± .0002"

FEATURES:

(1) Precision ground on all external surfaces to a maximum permissible error for squareness of .0004" per inch. Not cumulative!
(2) Dovetailed slide giving rigidity and parallel location of jaws under all circumstances.
(3) Slide adjustable for wear by six socket headed screws in base allowing maintenance of parallel slide.
(4) Hardened and ground jaws can be removed for replacement with special jaws or for reconditioning.
(5) Totally enclosed screw. Grit or dust cannot get into the leadscrew.
(6) Screw operated by knurled handle or bar.
(7) Dust-proof means of oiling leadscrew, provided by screw in end of handle.
(8) ALL PARTS HARDENED, except leadscrew which is made of High Tensile Steel for long wear.
(9) Groove provided all round base provides means of clamping vise to machine tables, etc.

CAPACITY

	No. 1	No. 2	No. 3
Width of Jaw	1-1/4"	1-7/8"	2-1/2"
Depth of Jaw	7/16"	11/16"	15/16"
Jaw Opening	1"	1-1/2"	2"
Weight lbs.	1-1/4	4-1/8	10

PRICES

No. 1	No. 2	No. 3
$24.50	$38.75	$67.50

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Threading oil allows machining of tough alloy steels

Habcool 318 tapping oil contains anti-weld ingredients that are blended and energized to withstand the extreme

pressures developed when tapping and thread chasing tough alloy steels.

A medium bodied oil, it is applied in small quantities by brush to tap or chaser. It will not throw from the work.

Free samples are available from manufacturer, the H. & B. Petroleum Co., Dept. RS, 799 E. 25th St., Paterson 4, N.J.

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Chatterless boring bar

It is claimed to be possible to take bigger cuts, smoother cuts, and run work through faster on any lathe or boring mill with the chatterless boring bar known as Silent Sam. Its design is based on the science of harmonics.

Inside of bar is bored out from both ends to various sizes, with smallest size in center of bar to diminish harmonic

vibration to a minimum. These diameters were determined by using a vibration meter and probing bar at every quarter inch to minimize such vibration. The cavity is filled with a shock

absorbing material—under a vacuum—producing a dead bar.

The special alloy metal also plays a part in enabling user to take a bigger cut at faster lathe and boring mill speeds. Bar is graduated each quarter inch so that depth of bore is readily known without measuring with a scale.

Pensco Products, Dept. BB, 527 Lexington Ave., New York 17, N. Y.

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Air cylinder for heavy duty service

Air cylinder has capsule type gland of alloy steel which is designed especially for heavy duty service. It has long rod guide, independently adjustable V rod packing. Bronze rod wiper ring prevents foreign material from entering the cylinder.

Cylinder heads are cut from steel plate. Heads, steel cleveses and steel

CUT THESE 5 COSTS IN YOUR PLANT

Machine-installation cost — cut 70%
Plant-layout-change cost — cut 90%
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Tool-change time — cut 80%

These proved savings are being gained by such companies as Inland Steel Products, American Type Founders, Johnson & Johnson, The Colorado Fuel & Iron Corp., Wyman-Gordon, Reed-Prentice, Bullard Company, and many more.

How? By using Barry Leveling Machinery Mounts to make production machinery mobile and to protect machines and buildings from damaging vibration.

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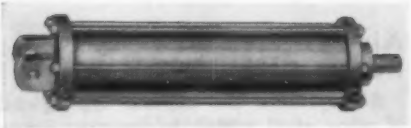

pistons are cadmium plated. Low friction impregnated leather cups. Piston rods ground and precision honed, hard chrome plated. Operating pressures are 150 psi on air and 500 psi in hydraulic service.

Six tie rod cage protects cylinder barrel in rough service. Available in strokes up to 18 feet, from 3" through 8" bore with a wide choice of piston rod sizes.

Densmore Eng. Co., Inc., Dept. KE, 235 E. Greenleaf St., Compton, Calif.

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Swedish drill chuck

Swedish precision drill chuck, the Rapid, is hardened and precision ground

Deburrs 1520

1" TUBE ENDS PER HR. on PINES END FINISHING MACHINE

Here's another outstanding example of how the Pines No. 600 End-Finishing Machine is setting records for production speed and efficiency. Today, at Configured Tube Products Company, Bellwood, Illinois, the Pines Machine (shownatright) performs inside and outside deburring on 1" steel tubing at net production rates of 1520 tube ends per hour. Such high-speed production is made possible by the exclusive design of the Pines Machine which enables the operator to clamp and feed work to the rotating cutters in one pass, so that one hand is always free for rapid stock handling.

Exclusive Features Speed Work

Still other outstanding Pines features such as quick, interchangeable tool holders, chuck inserts, 8-speed sheave (760 to 3920 rpm), sturdy spindle, and grease-sealed precision bearings assure fast, accurate work. The Pines No. 600 handles chamfering, pointing, facing, and reaming operations, as well as deburring, on stock diameters up to 2". Maximum feed stroke is 1-1/4". Automatic air-operated units for higher production work, and larger sizes up to 5" capacity are also available.

PINES ENGINEERING CO., INC.
Specialists in Tube Fabricating Machinery
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PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

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The Model IH-3A is precision engineered for **brazing, soldering, hardening, annealing, hot forming, shrink fitting** and **bombarding** for use in —— machine shops, heat-treating shops, research laboratories, production plants . . . Typical of the INDUSTRON line, this model provides uniformity of results, accuracy, and economy of operation. Special features include:

MODEL IH-3A

- TWO OUTPUT CIRCUITS
- SIMPLIFIED CONTROLS
- POWER OUTPUT CONTROL
- HIGH KVA TANK CIRCUIT

Since Model IH-3A contains high and low impedance output circuits, it is the only 3KW unit on the market offering both circuits as standard equipment.

Other models available up to 100KW. For further information on specifications or individual applications please write to home office.

INDUSTRON CORP.

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LAY-OUT DYE
(Purple)

A *new*, easy-to-use, dependable, spray Lay-Out Dye for tool, die, pattern, or template layout on metal. Dries instantly—shows up in sharp relief.

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For layout on metal and quick identification of bar stock, sheets, strips, or parts. Also dries instantly and shows up in sharp relief. Available in brush-in-cap cans and larger containers.

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in every part. Chuck tightens automatically without key.

Opening the chuck after operation is easy even after heaviest cutting because of the ball bearing construction. Spindle and ball bearings are protected against dirt.

Karl A. Neise, 404 Fourth Ave., New York 16, N. Y.

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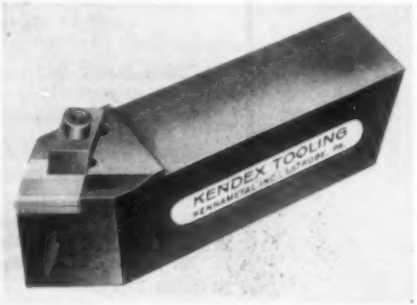
Profiling tool for both rough and finish cuts

A throw-away insert profiling tool for contouring machines, for both roughing and finishing cuts, was designed to prevent the insert from shifting. A rigid support and clamp hold the insert in proper cutting position when



the direction of cutting forces changes as in plunge or face-out cuts.

The tool assembly includes a chip breaker plate, indexable insert, and insert seat, all solid carbides of different grades. Inserts are of two general types, right-hand and left-hand, and have two indexable cutting edges with a positive rake angle that minimizes power requirements and tool pressures, and thus assures accurate duplication of shapes, the manufacturer claims.

Chip breaker plates control chip flow over a wide range of feeds and depths of cut and eliminate chip breaker grinding. Insert seats have an offset to provide a hard back-up surface that will not "mush out" or permit the insert to shift under heavy cuts. Holders, consisting of hardened alloy-steel shank and clamp, are available in three types and 18 sizes.

Kennametal Inc., Dept. RH, Latrobe, Pa.

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CLARK Diamond Cone Penetrators are exactly right for your "Rockwell" hardness tester, whether or not it bears the CLARK name. Every step in their manufacture, from careful diamond selection to expert lapping, leads to a precision product that will give you precision results. Yet CLARK Diamond Penetrators cost surprisingly little.

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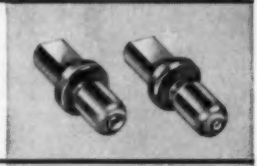

CLARK Test Blocks, in various hardness grades, provide a quick, sure, and simple method of checking the accuracy of your "Rockwell" type hardness tester.

Write today for descriptions and prices.

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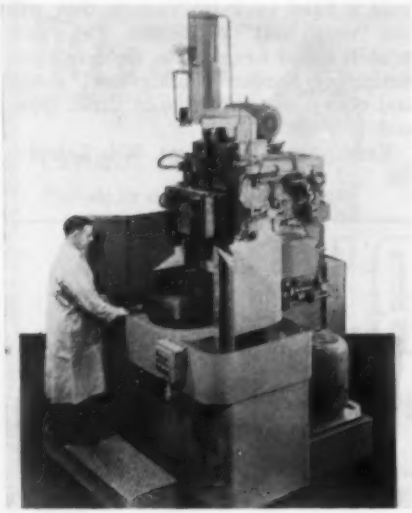
Finishing machine for rough or precision finishes

Single station precision finishing machine performs: contour turning, boring, and facing; straight boring; surface grinding; surface honing; i.d. grinding; o.d. grinding; contour milling; horizontal or straight milling.



Designed for jobs requiring rough and/or precision finishing operations, the BL-1 machine utilizes standardized, cam-actuated head.

Machine is available in single or double spindle models and with single, multiple or variable spindle speed drives. Motor drives from three to twenty hp per spindle are available. Gross slide travel is five inches; longitudinal slide travel is six inches.

Hoern & Dilts Div., New Britain Machine Co., Dept. BJ, Saginaw, Mich.

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Backgeared press

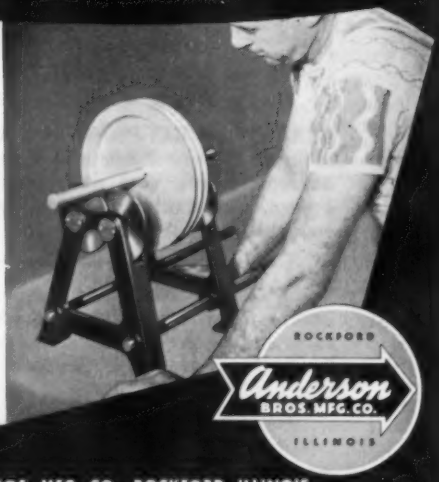
This 37-ton open back inclinable backgeared press operates at approximately 45 strokes per minute; may be

PRECISION BALANCING WAYS

Save Time . . . Cut Cost

Balance rotating parts easier, faster, more accurately with supersensitive Anderson Balancing Ways. No setup, no leveling, no centering. Chilled iron discs, ground and balanced to extreme accuracy, rotate with minimum friction on special bearings. Glass-hard spindles and bearings prevent wear or ball-bearing indentations when balancing heavy weights. Superior accuracy lasts throughout long life. Proved and preferred over 40 years. Write for bulletin 1-5.

Swing	Between Standards	Capacity in lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
60 in.	30 in.	2,000
72 in.	66 in.	5,000
96 in.	88 in.	10,000



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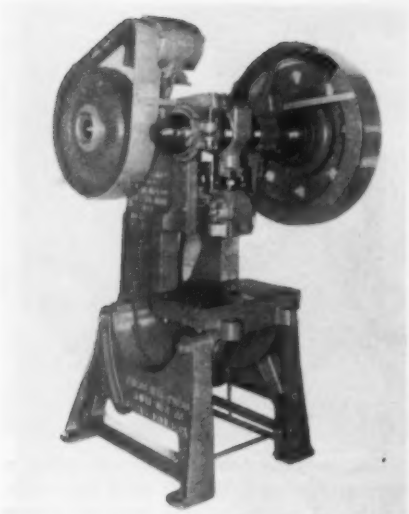

used for dial feed or other automatic feed equipment.

Designed for drawing parts and other backgeared applications, press has heavy reinforced Unicast alloy frame, 3¼" diameter crankshaft with bronze main bearings. Roller bearings in the flywheel and on the back shaft press has 14" x 25" bolster.

The standard stroke is 2½" and, if desired, can be arranged for up to 4" stroke. The standard shut height is 10" and the press may be arranged for shut height up to 20". Back shaft bearing supports are an integral part of the frame.

Press-Rite Div., of Sales Service Machine Tool Co., 2363 University Ave., St. Paul, Minn.

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Lapping machine

The Lap-King is a 15" x 14½", bench-type portable lapping machine capable of producing lapped surfaces accurate to 11.6 millionths of an inch.

Quality control is easily maintained because the machine relaps its own

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on equipment, parts, panels, etc.
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NEW FLEXIBLE, CHIP-PROOF GRAVO Flex
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Shear it, bend it, form it, punch it. Laminated in contrast colors for clear visibility. No filling. High resistance to impact, scratching, flame, moisture, solvents. Costs less, lasts longer. Send for free sample.
Do all your marking fast, on-the-spot, with unskilled labor. Use portable, tracer-guided ENGRAVOGRAPH. Over 17,000 in use.

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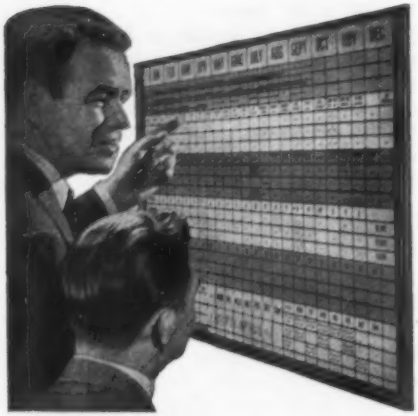

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plates, one against the other, after a normal job run. This is said to assure consistent optically flat lapping plates for automatic accuracy of lapped work. An hour meter records the amount of lapping time on each plate. An automatic timer, operating in a one hour cycle, allows job time control.

Byron Jackson Pumps, Inc., Dept. KE, P.O. Box 2017, Terminal Annex, Los Angeles 54, Calif.

Use postpaid card. Circle No. 97

Automatic setup clamps

PowRlock automatic setup clamps can be installed on any standard machine, jig, or fixture to replace nuts and bolts. The basic unit consists of an air control, hydraulic booster, and one of three models of clamping heads. Compressed air from the factory system is passed through a filter-lubricator to the on-off control valve. With the valve open, air enters the air-hydraulic booster, producing hydraulic pressure on the oil line. This pressure acts on the clamping heads, producing great locking force.

Boosters come in three sizes, capable of operating one, two, or four heads. Locking force is exerted by a 1½" piston which moves through a maximum

Hand stoning cutting tools pay off in better cutting speed and longer tool life. Millers, lathe bits, drills and other cutting tools all can be made to give superior performance with an INDIA (for regular work) or HARD ARKANSAS (for superfine finishes) oilstone file.

Over 35 different shapes and 97 sizes are available to help you reach just about any surface that needs sharpening, deburring, etc. The Hand Stoning Handbook gives full details. Write for your free copy today. Address Behr-Manning Co., Troy, N. Y. Dept. MT-7.

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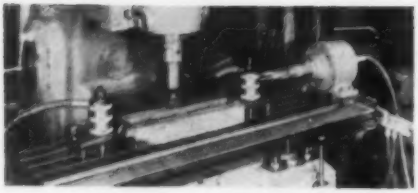

½" power stroke. Recommended practice calls for travel to be limited to approximately ⅛". Multiple point clamping can be achieved by using two or more interconnected boosters, with one air control.

Major uses: clamping workpieces to machine tables, production fixture; locking two or more parts of a production fixture together; locking two or more mating parts of a workpiece together; exerting direct force, as a small hydraulic ram or press.

Wilton Tool Mfg. Co., Inc., Dept. RB, 9525 Irving Park Rd., Schiller Pk., Ill.

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For men who know Drill Heads Best...
it's always
U. S. DRILL HEAD
5 to 1

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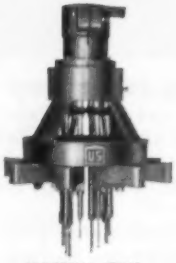
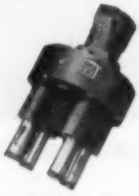
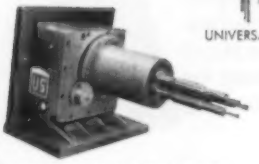
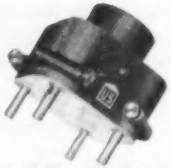
OIL CIRCULATING


UNIVERSAL JOINT


FIXED CENTER
GREASE LUBRICATED


INDIVIDUAL LEAD SCREW TAPPER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US DRILL HEAD
UNITED STATES DRILL HEAD CO.
BURNS STREET • CINCINNATI 4, OHIO

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Grease and grime remover

Strip-Grease is an emulsifying grease solvent in concentrated form. It can be applied to engines, motorcycles, farm, shop, and yard equipment to remove grease and grime. The quart can has a squirt applicator.

Solvent can be used as is or mixed with kerosene, fuel oil, etc. Applied to the surfaces, it penetrates and causes deposits to break up when rinsed with water so that they can be readily flushed away.

Graymills Corp., Dept. BB, 3705 N. Lincoln Ave., Chicago 13, Ill.

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- Positive barrier against corrosion that lasts for MONTHS
- Protects any metal—even delicate MICRO-finishes
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Write for Data Sheet No. RP-100 "FROIL FOILS RUST"

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15 BANK STREET
STATEN ISLAND 1, N. Y.

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AIR GRINDERS

MODEL JA
50,000 R.P.M.
$42.00
IN U.S.A.

Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

The RPM's stay up while grinding . . . not only when the grinder runs idle. That means better work—longer wheel life.

High speed grinding with small wheels was a Madison-Kipp development of the late twenties. It was born out of a pressing need in our tool room. Because tool room grinding problems are universal, we believe it will pay you to utilize Kipp grinders in your tool room as generally as we do in our own.

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MADISON-KIPP CORP.
207 Waubesa St., Madison 10, Wis., U.S.A.

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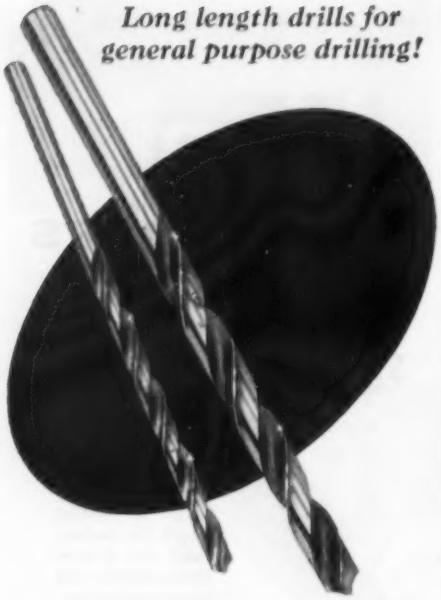
Long length drills for general purpose drilling!



ACE

TAPER LENGTH DRILLS

Feature for feature, you can't beat Ace Taper Length Drills. First, because they're made of the finest quality high speed steel properly heat treated to assure the ultimate in uniform hardness. Second, because they're produced by the Ace-originated "ground-from-the-solid" process to give them smoother, more highly polished flutes with keener, stronger cutting edges. And finally, because they cut faster, last longer, give you more production per drill at lower cost.

Call your local Ace Drill Distributor today!

ACE DRILL

ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

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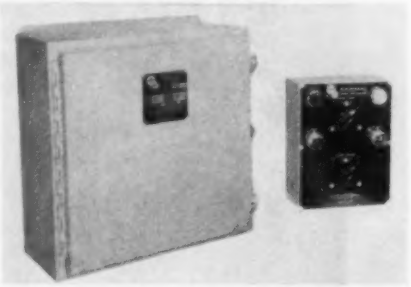
Magnetic chuck control units

Three basic types of Power-Grip control units are available for use with Sundstrand magnetic chucks rated up



to 4000 watts. Demagnetizing cycle requires a maximum of seven seconds. The units, consisting of a dust-tight control cabinet and remote control station, operate from a 110-volt ac pilot circuit.

Type A units are rated up to 125 watts, with Types B and C available in a total of 15 ratings, ranging to 4000 watts. Basically, all models operate on the same principle, using a heavy-duty power transformer and a selenium rectifier in a single-phase bridge circuit to furnish dc power to the magnetic chuck.

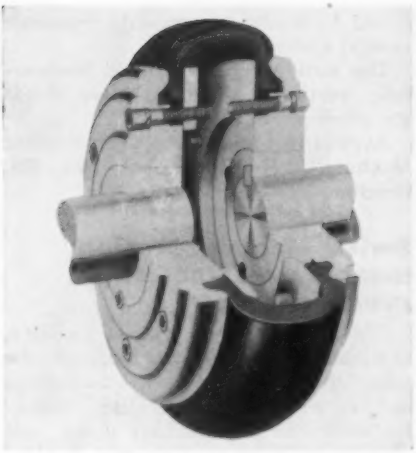
Sundstrand Magnetic-Pneumatic Products Div., Sundstrand Machine Tool Co., Rockford, Ill.

Use postpaid card. Circle No. 99

Flexible cushion coupling

Para-flex flexible coupling is able to handle angular misalignment, parallel misalignment and end-float, and in any combination. The flexible member also cushions shock loads and diminishes torsional vibration, thus protecting both the driver and the driven machine.

The coupling consists of a flexible tire clamped between two hubs which



are mounted on the shafts to be coupled. The flexible member is held between the flanges and clamp rings of the hubs.

Both hubs of the coupling are machined to take Taper-Lock bushings. These give the equivalent of a shrunk-on fit on the shaft and permit quick and easy application to shafts of different diameters without costly reboring.

Coupling will take angular misalignment up to four degrees, parallel misalignment up to ⅛ inch, and end-float up to 5/16 inch—contingent upon the size of the coupling and the duration of the conditions—or it will take all of these simultaneously.

Because there is no metal-to-metal contact in the coupling, it requires no lubrication. Developed in West Germany, it has been adapted to the standards of American industry, is available in capacities up to 600 hp at 900 rpm.

Dodge Mfg. Corp., Dept. HS, Mishawaka, Ind.

Use postpaid card. Circle No. 100

Drilling, reaming unit

For heavy duty drilling, reaming, spotfacing, boring and counterboring, milling, and chamfering, the No. 4 Hy-

INCREASE PRODUCTION...

Above is shown a 6M Fen Automatic Wrench operating a 28" heavy duty chuck.

• • •

For detailed information regarding the application of the Fen Automatic Wrench to your machines, phone, wire or write.

ELIMINATE
"WRENCH WRESTLING"

You can put the advantages of the Fen Automatic Wrenches to your work right in your own shop on machines already in operation, or specify them on your new standard or automatic machines.

THE FEN
MACHINE COMPANY
28914 Lakeland Blvd.
Wickliffe, Ohio

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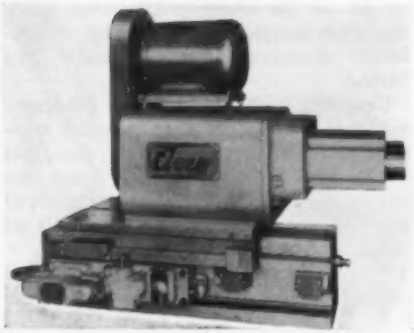

dro-Way unit includes the following features: 5 to 20 hp; 12,000 lb. maximum thrust; non-metallic ways; hydraulic control panel which simplifies piping; standard electrical components.

It provides positive depth control; adjustable coarse, fine, and jump feeds; 12-inch travel; simple cutting tool change because of long stroke; separate pump and tank units to permit additional hydraulic components from one central system.

The unit may be mounted horizontally, vertically, or on an angle. Heads are provided to suit the job.

Avey Div., Motch & Merryweather Machinery Co., Dept. HS, Box 625, Cincinnati 1, O.

Use postpaid card. Circle No. 101

Swiss electric erosion machine for tool shop, precision use

The E-400 electric erosion machine, manufactured in Switzerland, can be used for a variety of jobs in tool shops and in small series precision manufacturing; to manufacture tools and dies in steel or in tungsten carbide; to grind and sharpen tools and dies; to change and recondition existing dies, without heat-treating; to machine any material which is a conductor of electricity.

An electrode of the form and shape

Labor Saving Production CHUCK

Will pay for itself in 60 to 90 days

On turrets, engine lathes, cutting-off machines, drill presses or any type of chucking machine, the Barker Two-Jaw or Three-Jaw hand operated chuck will increase production up to one third and actually pay for itself while doing it in from 60 to 90 days. Hand lever eliminates pneumatic and hydraulic systems, yet closes and locks jaws with lathe running or stopped. Over 30 years of labor saving, production boosting operation.

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CHUCK DIVISION
THOMAS HOIST CO.
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to be machined in a die or other part is made from an electrical conducting material such as brass or bronze. The form of this electrode is automatically reproduced in the workpiece by concentrated electrical discharges.

Complicated shapes or contours can easily and automatically be reproduced on the workpiece. The machine is claimed to work as easily on soft metals as on hard materials like carbides or hardened steels.

Surface or profile grinding can be performed by the erosion process, using copper instead of diamond wheels. For this purpose the electrode or wheelholder can be rotated, using an electric motor mounted on the head of the machine. The head can also be swung to a 30° angle on either side.

The Electro-Spark Co., Inc., Dept. BB, 23 E. 26th St., New York 10, N.Y.

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1	30.00	10.25
1½	54.00	15.00
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These diamonds can be set in any shank to your specifications for $1.00 each extra.

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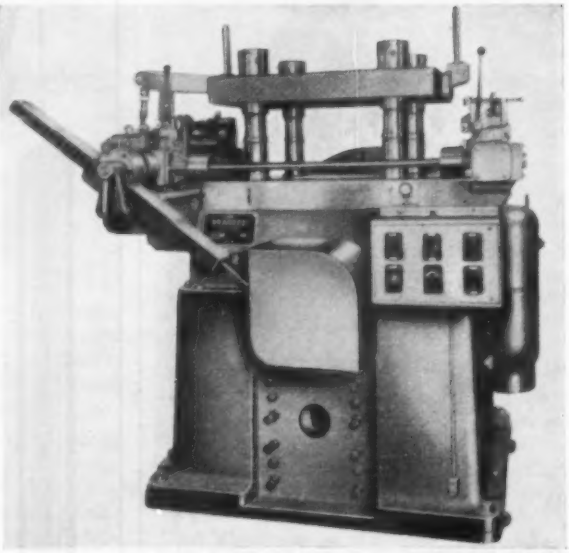
Press Stamps Pre-Tempered Steel .020" to .040" Thick

A 90-ton press and cemented carbide dies are being used to stamp business machine parts from pre-tempered steel .020" to .040" thick. The parts come out of the die in finished form made to required hardness, thus eliminating second operations such as heat-treating, shaving and straightening.

The press is only 75 inches high. It does not require a pit. Standard die area is 16¼ x 45 inches.

Brandes Press Co., Dept. RH, 6408 Euclid Ave., Cleveland 3, Ohio.

Use postpaid card. Circle No. 103



the Contour-Rex DRESSER and RECTIFIER

NEW WAY TO PRECISION—FORM GRINDING WHEELS USING ONE TO ONE TEMPLATES AND TOTALLY NEW RECTIFIER TO CORRECT TRACER FOR WEAR OF DIAMONDS.

Dressing unit, $230.00

- Combines platen and diamond head 3 diamonds and 3 tracers. Diamonds not included.
- Form dresses HARD as well as soft wheels without removing work from grinder.
- Smallest inside radii and fillets limited only by point of diamond.
- Prices subject to change.
- Prices F.O.B. East Orange, N.J.

Rectifier, $650.00

- Combines checking and trueing of tracer and diamond relationship.
- Tracer rectified by half-rotating motion of diamond head. Tracer ground against small grinding wheel directly below.
- Checking done with similar motion on side of indicated square easily checking trueing to accuracy of .0001".
- Master square and holder for checkers included.
- One rectifier used for several dressers.

FORM-ALL MFG. CO.

Providing: "The Engineering Service for ALL Form Grinding"

364 Glenwood Ave. E. Orange 2, N. J.

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Wheel rim automation line

The Wheel Rim-amatic, a wheel rim automation line, is a self-contained unit. It is completely wired and ready for use. It comprises a series of three forming machines, with automatic load and unload mechanisms, electrically interlocked to form a continuous line.

Before the wheel rims are fed, automatically, into line, these preliminary operations take place: strip stock is run through a cut-off, hoop forming and welding machine; the weld is trimmed; the initial partial form is pressed.

Operations which take place in the automation line: wheel rim is guided through a gravity chute and checked for proper position as it approaches the load station. When the wheel rim reaches the load station, a signal energizes the feed forming machine mechanism, and the wheel rim is indexed to a position in front of the form roll. Next, the fixture and the wheel rim are

THE NEW IMPROVED **PALMGREN**

Rotary and Indexing Table with Graduated Rotary Feed

No. 86 Table

The No. 86 Rotary and Indexing Table by Palmgren has been a basic tool for years, and now with these new improvements it is even more essential than ever in lowering costs and increasing production in every metal working or wood working shop. Check these features: 8" dia. top with 5/8" x 1" x 5/16" T slots. Rotary Top graduated to full 360° with rotary feed positive through worm and gear with ratio of 40-1. Rotary indexing dial accurately graduated in three minute intervals. Two hold down screws furnished to lock table top in position after indexing. Overall height is only 3 1/4" which makes the No. 86 an ideal tool for jobs where the fixture is large and takes up too much distance between the spindle and the machine table. Two 5/8" keys and screws are provided for machine mounting. Ruggedly built for years of precision work. #86

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HOGGSON

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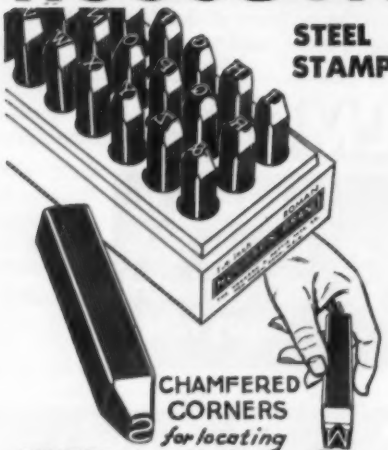

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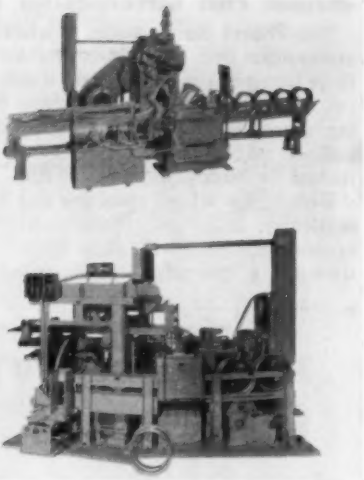

moved so as to load the wheel rim over the lower form roll. The lower form roll then raises to engage the

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FLAT TWISTED AND ROLLED SECTION

Unexcelled in Quality and Performance!

• SINCE 1903

HI-DUTY *Flat-Twisted and Rolled Section* Drills are produced by forging and hot twisting bars of high speed steel. This method improves the structure by preserving the grain of the steel. Sizes range from ½" to 3¼" and larger. Milled type drills are also available—from 1/64" to ½" diameter. Hi-Duty means long-lasting economical service!

SPECIAL DRILLS

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FLEETWOOD, PENNSYLVANIA

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upper roll, and perform the forming operation. A guide mechanism maintains perfect wheel alignment while the wheel rim is being roll formed.

The lower form roll then lowers the wheel rim into the fixture, and the fixture is moved out to its index position. The index mechanism then indexes, and the formed wheel rim is ejected into a chute to the next forming machine in the unit. At the time of ejection, the next wheel rim is being formed in the machine. This series of operations, repeated automatically in the second and third forming machines, provides continuous precision roll forming.

A shuttle transfer mechanism moves the wheel rims to the load position on the final sizing press—from a vertical plane in the third forming machine to a horizontal plane in the final sizing press.

LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.

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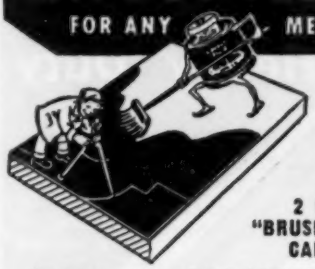
FOR ANY METAL



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OMEGA JIG BORER

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- 16 Spindle speeds from 35-1500 rpm.
- Hardened and ground screws
- Trays for dial indicators and measuring rods, motor and controls, included.

PRICE fob, New York **$8600.00**

Optical measuring system with overall accuracy of .0002" (available at additional cost)

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Live Centers

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NIELSEN, INC. LAWTON, MICH.

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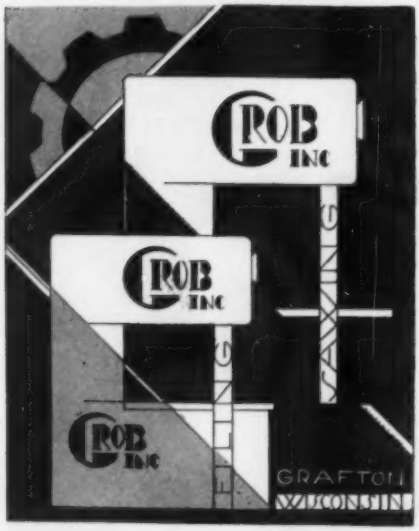

GROB INC. Grafton, Wis.

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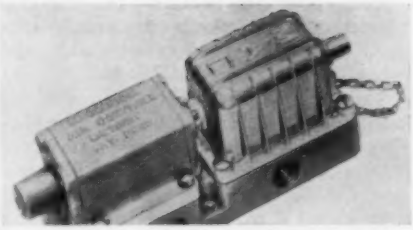

Air valve body and solenoid independent of each other

Air valve that meets all J.I.C. requirements has completely independent body and solenoid. Each can be removed separately from the base without disturbing the other. The valve also features an integral conduit box to make it more compact and an improved solenoid with new shock-resistant mountings.

Mechanical Air Controls, Dept. BJ, 10030 Capital, Oak Park, Detroit 37, Mich.

Use postpaid card. Circle No. 106

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CAP SCREWS • COUPLING BOLTS
SET SCREWS • MILLED STUDS
. . . our specialty

* Wm. H. Ottemiller Co.
YORK, PENNA.

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Indexing machine built around two drill units

This special automatic indexing machine, recently produced for a prominent aircraft engine manufacturer by the Hoefer Mfg. Co., is built around two Hartford automatic drill units. Mounted on the horizontal unit is a two spindle offset drill head which drills, spotfaces, reams, and hollow mills a group of bosses, two at a time, in the horizontal plane. Since this group of bosses has two different levels, the drill unit automatically raises for the insertion of a spacer after the lower level of bosses is completed; then the drill is again lowered, lining up with the upper level of bosses for the completion of the operation.

The operations are accomplished in three passes. The first pass drill and spotface is followed by a tool change, after which the cycle is repeated for the reaming operation. Again the tools

Introducing the new FEDERAL "55"

Handles work formerly confined to larger, more costly presses!

A great press—just check its dimensions! The "55" is outstanding for other reasons, too. Rugged. Precision-built. With the many *extra quality* features that have made FEDERAL PRESSES famous the world over. Available in geared or flywheel models, with mechanical or air clutch. WRITE FOR NEW CATALOG.

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56-ton capacity

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• ECONOMY •
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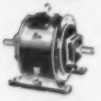

Horizontal or vertical drives; inputs from either side; right, left, top or bottom outputs. A size and type for every application. Ratings from 1/20 to 400 h.p. Ratios up to 10,000 to 1.

Compact precision-built Abart Speed Reducers make the most of your power. Simplified trouble-free design and construction assure lower operating and maintenance costs.

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4829 WEST 16th STREET • CHICAGO 50, ILLINOIS

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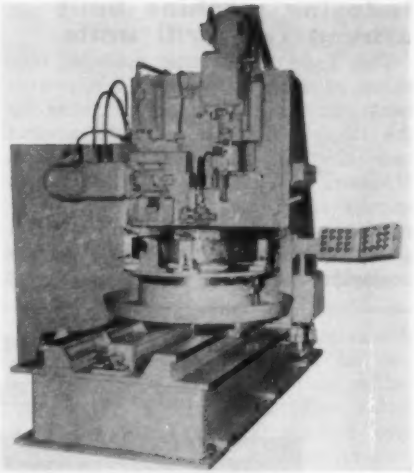
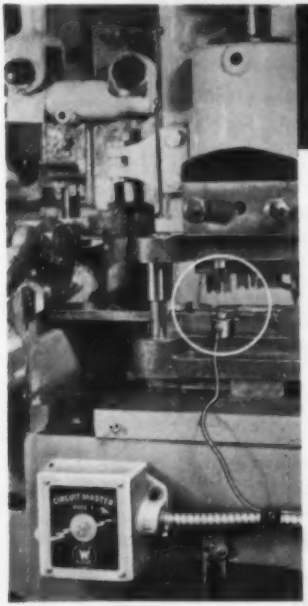


are changed and the cycle repeated for the hollow milling operation. The sealed, pumpless hydraulic system employed within the drill units provides the flexibility required for this job. Con-



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• Shuts down automatic power presses before dies and tools are broken • Completely automatic • No adjustments • No operator supervision • No maintenance • Simple installation

The revolutionary new mechanical-electronic control . . . CIRCUIT MASTER stops any automatic press on first contact with overloads due to jams, improper feeding, freezing of parts, pile-ups, oversized stock, buckling, double thickness, etc.

Unlike microswitches, fingers, etc. which are sometimes used to protect specific sections of the die and require constant adjustment, the CIRCUIT MASTER will protect the entire die.

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trols conveniently grouped at the nose of the unit permit quick setting of rapid approach, varied operations performed by this equipment.

One additional cycle is made with the vertical unit drilling two .078 cross holes through the bosses at right angles to the horizontally drilled holes. The work table is then moved forward for the removal of the piece.

Hartford Special Machinery Co., Dept. DR, Hartford, Conn.

Use postpaid card. Circle No. 107

Retractable anvil snap gage

Dial indicator snap gage is shown being used to check the rolled spline on an axle shaft. The gage is also used to check gear tooth pitch diameters.

Retractable anvil is said to result in faster operation and more pieces checked per hour. Gage is portable.

There are no pivots, bearings or cams in its internal construction; the only wear points are on the carbide anvils

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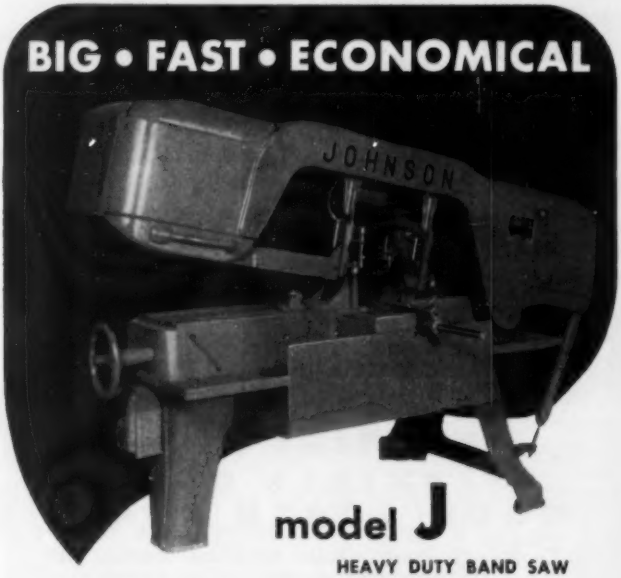

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HEAVY DUTY BAND SAW
(WET OR DRY)

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and in the indicator. Available in size ranges from ¼ to 5 inches, with carbide anvils furnished to suit individual job requirements.

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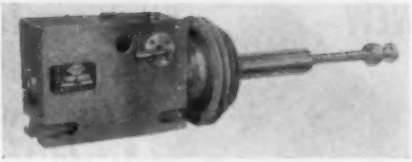
Borer for limited space



Designed for special installations where space is limited, the new Hydro-Borer Model S-6 is small and compact. It weighs only 75 lb., is easily mounted on workholding fixtures or assembly jigs. Over-all dimensions are 29½"x6¾" x3¾".

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$195.00 with oak case

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The spindle diameter is 1¼" with a No. 2 Morse taper. The taper can be supplied either concentric or eccentric. Eccentric taper permits increasing bore diameter a total of .014 in increments of .001 without resetting the tool bit. The machine is capable of boring within a tolerance of .0003" and producing a finish of 30 micro-inches or better.

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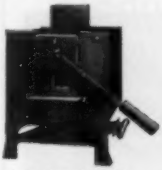
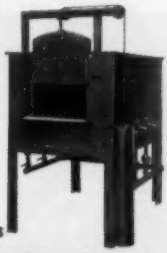


High Speed Full Muffle Furnaces



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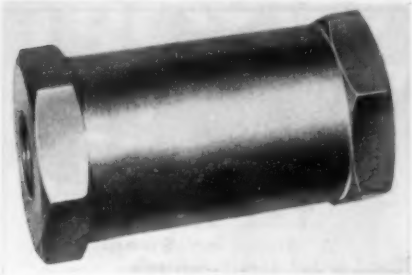

⅜ in. pipe size, it has a differential cracking pressure of 1 psi maximum. Differential sealing pressure is less than 1 psi.

The unit withstands operating pressures of up to 125 psig and temperatures up to 175 degrees.

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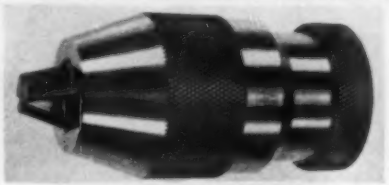

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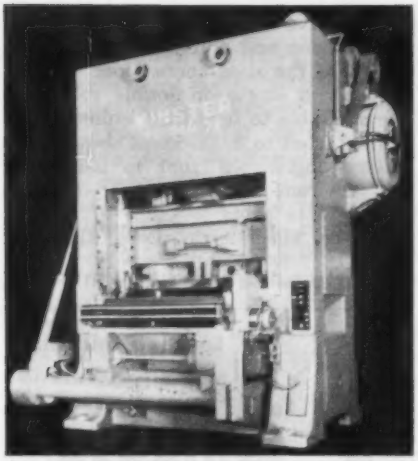

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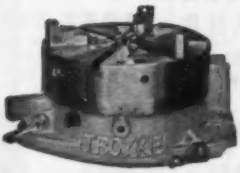

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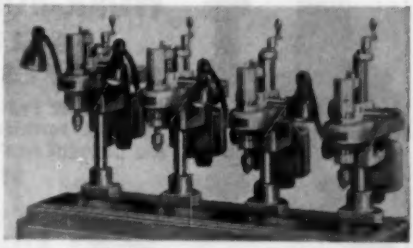

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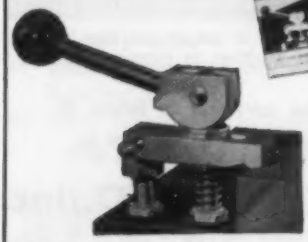

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220	245	270	295	320	345	370	395	420	445	470	495	520	545	570	595
221	246	271	296	321	346	371	396	421	446	471	496	521	546	571	596
222	247	272	297	322	347	372	397	422	447	472	497	522	547	572	597
223	248	273	298	323	348	373	398	423	448	473	498	523	548	573	598
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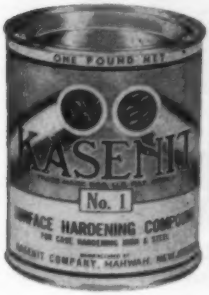

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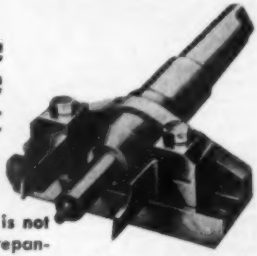

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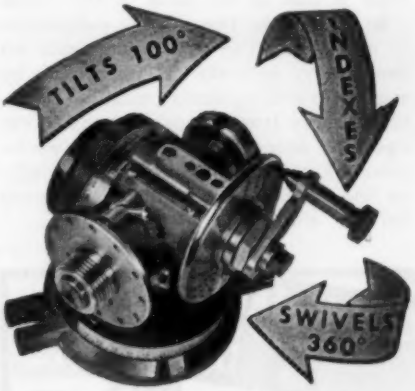

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Magnaglass Mfg. Co., Inc., Dept. RH, Fredonia, N.Y.

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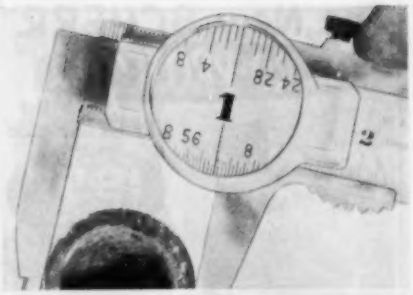

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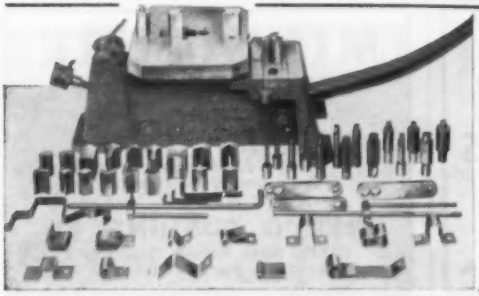

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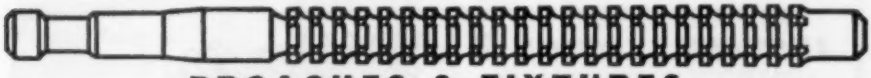

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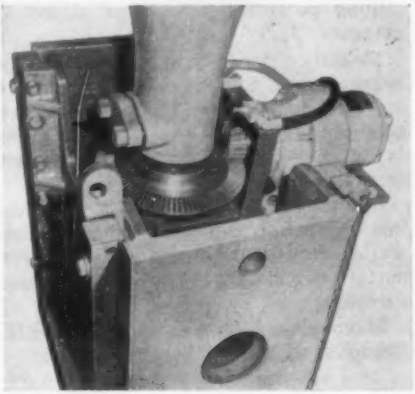

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Hole Sizes—No. 80 to 3/32"
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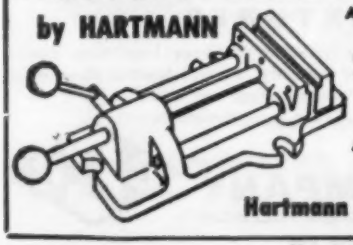

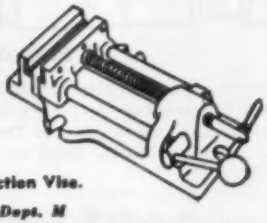

The
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Adjustable Pressure Production Vise.
For Information Write Dept. M
Hartmann Mfg. Co., 1637 Goold St., Racine, Wisconsin

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sets, can accommodate the forming requirements of a group of components. Tooling changes can be accomplished speedily.

A one-half to one horsepower electric motor, depending on size of the press, is mounted directly on the press ram. Up-Down lock type control buttons mounted at the operator's station actuate the motor. A pinion gear mounted on the motor shaft revolves the adjusting screw thru the bevel gear, machined as part of the screw. The adjusting screw is threaded in the pitman and connected to the ram, thus moving the ram up or down depending on direction of travel of the screw. A clamping cap on the pitman secures the adjusting screw at the desired position. Thus the press ram can be quickly adjusted when changing from one die set to another.

Verson Allsteel Press Co., Dept. RB, 9347 South Kenwood Ave., Chicago 19, Ill.

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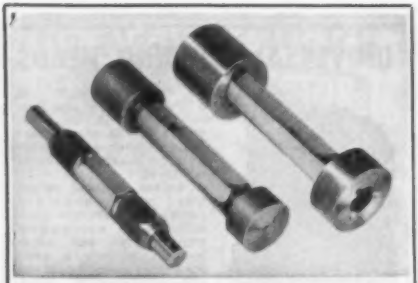

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A dust collector for small machine operation can be placed at any small grinding, polishing, buffing, sanding, sand-blast, or other dust-creating machine. The Dust-Master has an efficient non-overloading centrifugal blower driven by a high speed 1/3 hp ball bearing motor. This, with a large dust filter bag, is mounted on a cast aluminum cover which fits any ordinary 20 or 24 gallon waste can.

Chips and heavier particles drop to the bottom of the can; lighter particles are trapped by the dust filter bag. The unit is supplied with line cord, plug and switch and 5 feet of flexible 3" suction hose for attachment to any machine.

Furnished less the waste can, it weighs only 30 lb. When the waste can

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TOTE PANS
Sturdy 16 ga. metal. 20" long x 12" wide x 6¼" deep. Drag holes and handles at both ends.
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All hinges shown can be furnished with special holes, cutouts and bends to blue-print in metals to suit the job.
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AUTO MOULDING & MFG. CO.
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Lengths to 120"
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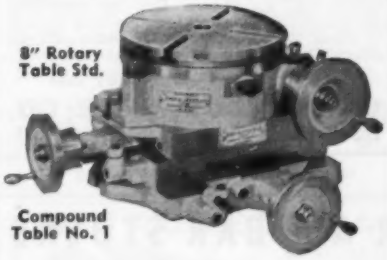

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★ COLLIS Equipment fills today's important production needs so well because they are made by men skilled in making this type of equipment. Supply the proper unit from a complete range of types and sizes for Drill Sleeves and Sockets, Lathe Centers, Chuck Arbors, and Drill Drifts. We will handle your orders promptly.

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Speeds from 60 to 300 f.p.m. Combined with a graduated metering valve on our fully hydraulic models permits choice of proper blade speed and pressure for maximum production and blade life from high speed or high carbon steel blades.

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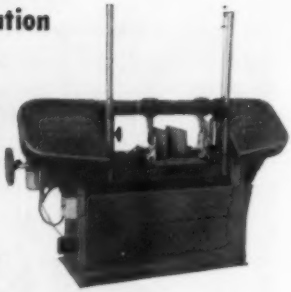

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Metal Cutting Band Saws
THREE RIVERS MICHIGAN

MODELS W & F

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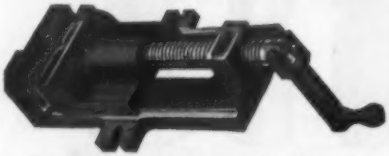
YOST DRILL PRESS VISE



This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

Offered in two sizes.

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1D	3½	4	12½
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Do you need a vise of ANY type?

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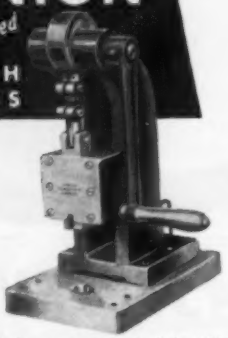

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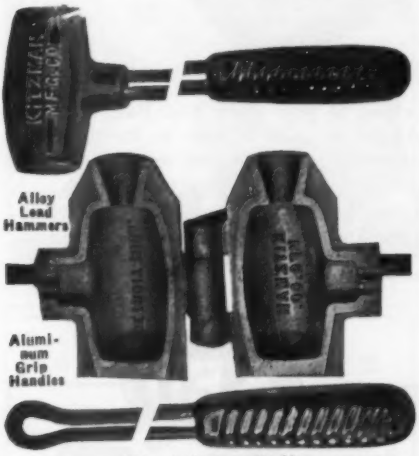

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(Size No. 1—6" jaws, 1¼" deep, opens 5". Price $60.00)
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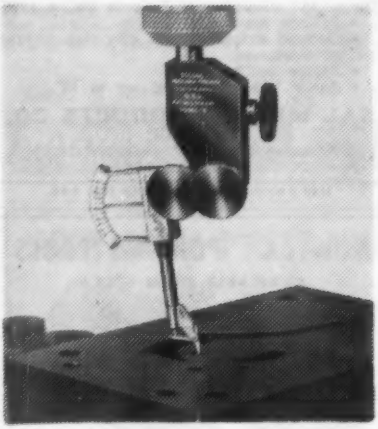

Simply turn the MICRO ADJUSTING SCREW

OSLUND MICRO ADJUSTING INDICATOR HOLDER saves a great amount of set up time. It is equipped with two thumb screws. One of these is a lock screw. You loosen this screw, move clamp until Indicator is in approximate position, then tighten. For final adjustment, simply turn the second screw, the Micro Adjusting Screw, until the Indicator pointer reaches desired position.

The Oslund Holder can be used in three positions:

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2. by a simple turn of the Holder Swivel Clamp you can indicate up to 5" diameter.
3. by application of the extension bar you can indicate up to 15" diameter.

This Holder was originally designed to be used with the Oslund Universal Indicator as this Indicator has a 360° reading face which eliminates walking around the machine or using a mirror. Whereas the Oslund Holder is most outstanding on our own Indicator, it can be used on the Federal Test Master and Standard Gage Check Master as well.

Adapter for Last Word Indicator available from stock. We can also make this Oslund Holder to fit all types of other Indicators.

DEALERS: TERRITORIES AVAILABLE

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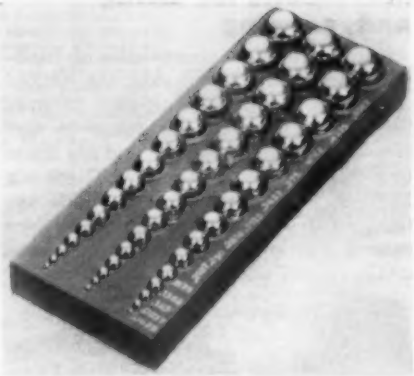

vided to pop them out. Ball sizes are listed on back of case in fractions and decimals; this list also serves as handy fraction-decimal conversion table.

Deltronic Corp., Dept KE, 1507 Riverside Dr., Los Angeles, Calif.

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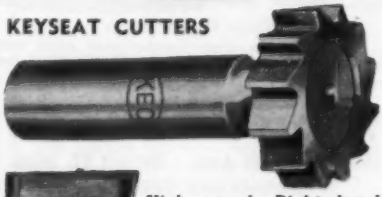
KEO

KEYSEAT CUTTERS



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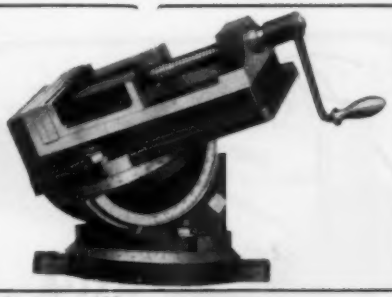

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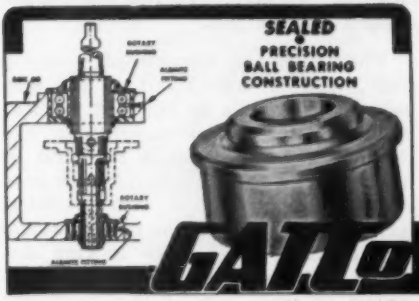

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FOR DRILLING, CORE DRILLING ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting and tool accurately below or above the work—or both.

Eliminates expensive tool construction—Reduces tool wear—Prevents seizure and pilot breakage—Especially adapted where precision is required.

Write for full information and prices

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Telephone PLYMOUTH 1472

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New 1957 Model "SS"

RADIUS DRESSER

OUTPERFORMS THEM ALL

Cut production time without sacrificing accuracy! Easy to set, easy to see, eliminates necessity of guard removal. Somerset Radius Dresser turns "tricky" jobs into routine operations.

New Low Price $124.50 with Diamond

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ALL AT LOW LOCAL PRICES

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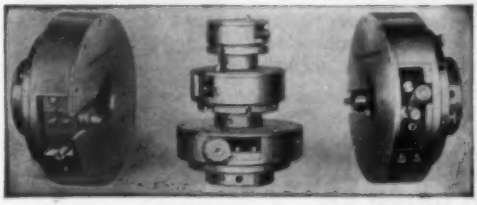

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FACING HEADS

with Automatic Feed

One-way Tool Feed—6, 9 and 12" sizes.

Two-way Tool Feed—8, 12, 16, 20, 24, 30, 36, 40 and 46" sizes.

Save many costly set-ups.

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Radial drill bores and reams

The 3', 12" Master radial drill is capable of sensitive boring and reaming as well as drilling—often without the use of pilots. Fixed arm always remains at the same height, can be swung 360°. To position workpiece, the machine has a motorized table that moves vertically on the column, placing the workpiece at the appropriate height for the job.

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To Your Specifications except Screw Machine Cams

Design Assistance Offered

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SELLEW (adjustable) stock drillheads will greatly increase your drilling output

STOCK SIZES AS SHOWN
No. 0-S (2 spin.)—drill cap. 1/8"
No. 0-AD (3 spin.)—drill cap. 1/8"
No. 0-D (3 spin.)—drill cap. 1/4"
No. 1-D (3 spin.)—No. 1 M. tap.
No. 2-D (3 spin.)—No. 2 M. tap.
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Send us your drilling requirements.

Sellew Machine Tool Co.
PAWTUCKET, R. I.
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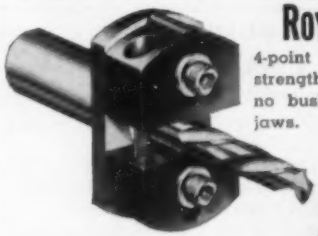
ROYEL TOOL HOLDERS



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4-point holding provides greater strength. Completely adjustable—no bushings, no collets, no extra jaws.

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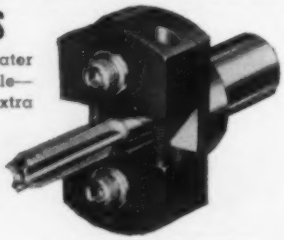
4221 EXCELSIOR BLVD.
MINNEAPOLIS 16, MINN.



Tap holders—releasing and non-releasing.

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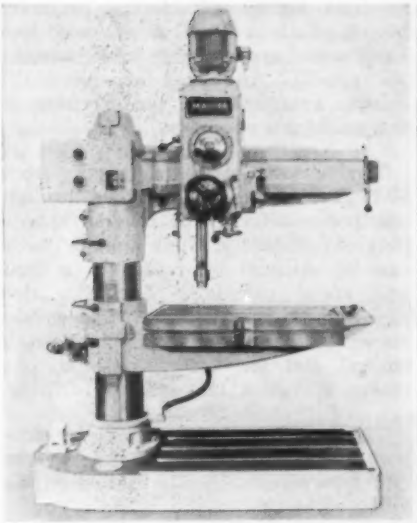

operation.

The fixed arm design, combined with a sturdy Nitrided spindle, fully sup-

BIO-GRANITE SURFACE PLATES

The truest working surface of all, made of genuine fine-grained Biotite Granite.

- won't warp
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- non-magnetic
- non-abrasive
- temperature resistant
- sizes 9"x12" to 60"x120"
- accuracy guaranteed .00005 on sizes up to 24"x36"

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— Plastic, Rubber or Glass Molds
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YOU CAN SAVE UP TO 60%

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Now 2 Major Improvements on the Fluid Motion

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***NEW* . . . ADJUSTABLE FRICTION BRAKE**

For Selective Table Sensitivity

***NEW* . . . CIRCULAR BALL BEARING RACEWAYS**

For Even Smoother Table Movement

MOUNTS IN MINUTES ON YOUR BRIDGEPORT AND CINCINNATI TOOLMASTER MILLS

Capacity 6" x 6" — 1 to 1 ratio with master. 2 or 3 dimensional with greatest accuracy. Single lever table control. Table "floats" on precision balls.

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At last, a top quality industrial sander that provides all the most wanted features – yet sells for so little. $89.95
complete with cord, plug, switch ready to use

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A few desirable distributor territories still available.

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ported for its full stroke, makes the machine highly suitable for precision boring. Both a hand wheel and fine hand wheel are available for advancing the spindle. A rugged one-piece 12" column contributes to the precision of the machine's operation.

Twelve spindle speeds, ranging from 60 to 2100 rpm, can be obtained through the pre-selector, with reverse speeds obtained instantly. Four spindle feeds can be selected by means of a feed and speed calculator especially designed for this machine, located on the center of the head. A graduated depth control dial for use during hand or power operation prevents overdrilling.

Tapping can be done quickly by simply shifting the forward and reverse clutch lever strategically located on the lower right side of the head.

The head, which travels on ground prismatic slideways, contains anti-

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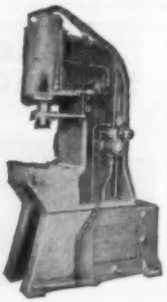

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Stops Losses
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Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

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PYRO SURFACE PYROMETER

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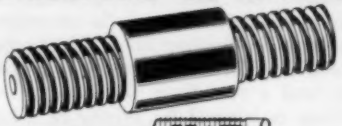

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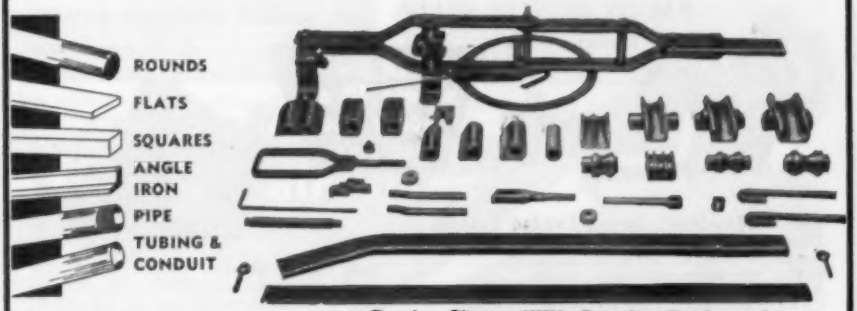
• Wrenchless, ready to use. • Practical, quickly set up. • Adaptable, replaces special equipment. • Versatile, 141 different dies available. • Dependable, a must for maintenance, limited production. • Invaluable, optional equipment makes jobs easier.

HOSSFELD *UNIVERSAL*® IRON BENDER



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Press marks up to twelve ⅛" characters into steel parts. Equipped with an 8 station dial feed, unit is simple and safe to operate. Operator's attention is required for feeding only. Discharge is automatic. Feeding is done at front of dial, and a foot from the ram.

Press is tripped by means of a hand lever located at a safe distance from ram and dial. It is easily convertible for various stamping operations by applying interchangeable station studs for each shape of part to be marked.

Specifications: Stroke ¾"; die space 6"; throat 4"; speed 60 rpm with back gear; ram bore 1"; fly wheel 10" x 13".

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THREAD GRINDING
AND
PRECISION MACHINING

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GRIND: RADIUS—ANGLE
QUICKLY EASILY

RADIUS DRESSER $44.00
Diamond $8.00

ORDER DIRECT on our 10 day money back guarantee

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Chatter Resistant, Spring Loaded Spindle
Hardened shaft—bearing adjustable for wear.
Diamond always perfectly centered.
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All surfaces ground true from hole.
CAPACITY—1½" Convex to 4" concave
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Ball Thrust Bearing.
24 Precision Ground Surfaces, not just milled & chrome-plated. DIAMOND BLOCK Slides In Ground & Lapped Housing, Can't Chatter. Set Accurately With Protractor or Sine Bar. Largest Bearing Surfaces.

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A matched set of transfer punches for toolmakers, machinists & tool cribs

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel—Carefully heat treated and tempered for long life—.0025 undersize to facilitate use—Blpck oxide finish.

SET #3-17; 28 punches with indexed stand—sizes 3/32" to ½", by 1/64"—plus handy 17/64" size. Length 4⅞" ONLY $17.90.

Single sizes available

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Manufacturers of Automatic and Semi-Automatic Lathes, Production Tracer Lathes, Automatic Centering and Drilling Machines, Automation and Work Handling Devices.

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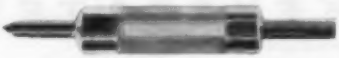
Retractable center holds tap or reamer straight and true in lathe or drill press. Precision made to last a lifetime.



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1 Minute

to locate an edge within .0005"!

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Kelly Fast Grip Toggle Clamps

R. J. KELLY MFG. CO.
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REDFORD STATION
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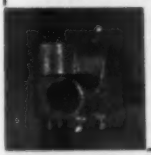
Make your own Storage & Pallet Racks



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UP TO 1/4" THICK

Sheet sizes 20" x 50"

Ideal for Machine Guards Windows Safety Shields Blue Print Covers

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GRAD. MECH. ENGINEER—20 years sales experience—know prod. and machine shop operation. Alert, aggressive and conscientious product promotion. Looking for top quality line with good potential. Send details to

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Manufacturers' Representative just returned from intensive tour of Europe contacting machine tool industry. Now representing firms and able to quote on timing controls, cutting, drilling, boring, wood-working, sharpening, tapping, reaming, smoothing, shaping, and/or contract production installations. Inquiries invited if you need high quality machine tools at lower cost.

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Aircraft Engine Parts and Pump Components, Hardened and Ground Parts, Small Castings. Send Blueprints for estimate.

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New product in automotive service field. Too big for present Mfr. Multi-million dollar potential. Inventory, prints, leads. $100,000.

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Extend the life of your
HI-SPEED
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By taking advantage of our Resharpening Service
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TOP VALUES
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PRECISION GROUND

ARBOR SPACERS

HARDENED AND GROUND WITH KEYWAY

Width Inch	⅞" bore 1¾" o.d.	1" bore 1½" o.d.	1¼" bore 1¾" o.d.	1½" bore 2⅛" o.d.
⅜"	$ .60 ea.	$ .70 ea.	$ .90 ea.	$1.10 ea.
3/16"	.60	.80	1.00	1.20
¼"	.70	.90	1.10	1.30
5/16"	.80	.90	1.10	1.40
⅜"	.80	1.00	1.20	1.50
½"	1.00	1.20	1.40	1.70
¾"	1.20	1.40	1.60	1.90
1"	1.50	1.75	2.00	2.40
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The Cutting Tool Discount House
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Telephone: CAnal 6-4992

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Try this Allman Universal Hand Tapper FREE for 15 days—

Results have proved that once this tapper is in your shop or tool-room and you find 70% of your free hand tapping time saved—it will stay there!
The new Allman hand tapper has these advantages:

- Articulate arm swings clear of large table for placement of work.
- Limitless number and sizes of tapped holes without moving work piece.
- Vise holds work as small as ⅜" square
- Floating tap locates itself in hole.
- Individual spindle holds taps, thus change requires only seconds.

Weight 500 lbs. Crated ready for shipment.
Write for pamphlet and information.

TOOLS, INC.
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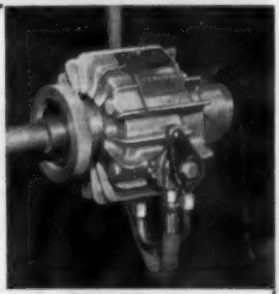
WILSON AIR COLLET CLOSER



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. . . for most lathes to 1" bar stock capacity

- Hold delicate parts without damage or adjustment
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- No adjusting for stock or part variations
- Finger-tip or foot control eliminates operator fatigue
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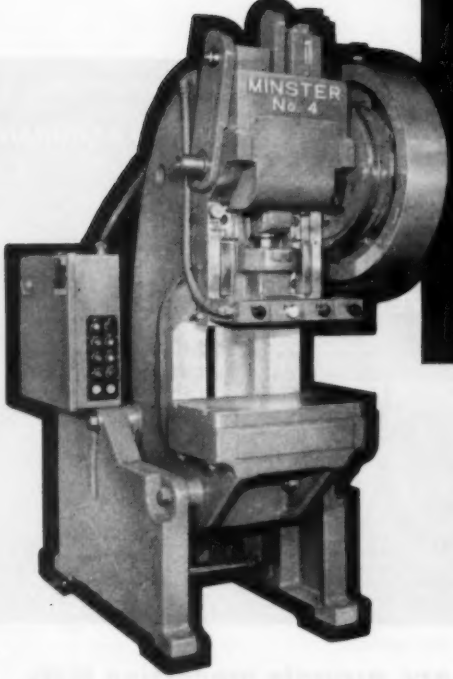
18th CENTURY INVENTOR OF THE POWER LOOM, EARNED THE MONEY TO STUDY MECHANICS BY SERVING AS A BARBER AND MAKING **MEN'S WIGS** FROM THE HAIR HE SAVED.

TO SHOW HIS SKILL

WITH TOOLS, HUGH ORR, AMERICAN GUNSMITH AND LOCKSMITH OF THE 1740's, ONCE FASHIONED A KEEN EDGED RAZOR FROM THE HANDLE OF AN **OLD SKILLET!**

SOME OF AMERICA'S MOST SKILLED MACHINISTS OF THE EARLY 1800's WORKED YEARS FOR ANNUAL WAGES OF **$100.00 PLUS BOARD!**



You Helped Design The Improved

MINSTER O.B.I.

You, as a press user, have often told us what features you wanted in an O.B.I. to improve your press operations. Most of the design changes in this improved Minster O.B.I. are based on your ideas, desires and demands.

CENTRALIZED CONTROL CABINET CONVENIENTLY LOCATED . . . NEVER INCLINES

For convenience and better operation, control cabinet mounted on leg remains vertical when press is inclined; is subject to less operational shock and easier to maintain.

NEW LEG DESIGN PROVIDES MORE WORKING SPACE

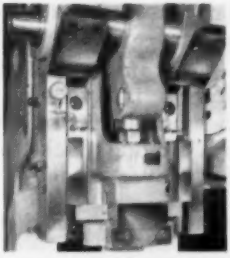
Square-cut legs give operator more room, a comfortable position in front of press. Inclining mechanism in leg and use of movable spacer rod provide more free space under press for tote pans or conveyors.

NUMBER	4	5	6
TONS CAPACITY	32	45	60

Flywheel or geared type. Drive can be mounted on either side. MINSTER patented Combination Air Friction Clutch and Brake Unit mounted within flywheel or drive gear on crankshaft.

HEAVIER FRAME FOR GREATER RIGIDITY, ACCURACY AND DIE LIFE

Frame closed in on top and front completely encloses bearing caps, thus providing better distribution of work forces. Connection cover keeps press cleaner—no oil drops hit operator.



GREATER CONNECTION STRENGTH — IMPROVED KNOCKOUT

Tail stock type connection screw locking. Increased connection strength and screw support.

T-Slotted Knockout blocks moving against frame surface give more positive knockout, are easier to adjust. No more bracket breakage.

FASTER, EASIER INCLINING

Inclining the press takes less time and labor with ratchet-wrench-operated mechanism located in press leg *at normal working height*. Die changes are made quickly in vertical position with greater safety, more accurate alignment and less die change-over time.

THE MINSTER MACHINE COMPANY • MINSTER, OHIO

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WILSON "ROCKWELL"—
THE WORLD'S STANDARD OF HARDNESS TESTING ACCURACY

WILSON "ROCKWELL"
HARDNESS TESTERS

A FULL WILSON LINE
TO MEET EVERY
HARDNESS TESTING
REQUIREMENT

FULLY AUTOMATIC
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SEMI-AUTOMATIC
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REGULAR
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SPECIAL
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SUPERFICIAL
•
MICRO & MACRO HARDNESS TESTERS

For easy, accurate production tests

Sensitive and Accurate as a precision balance —the WILSON "Rockwell" hardness tester insures the quality of your products and protects your good name as a manufacturer.

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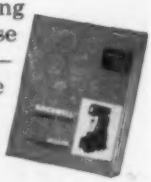

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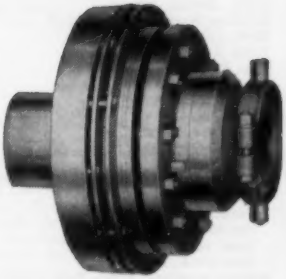

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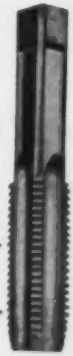
1-1/2	8-10-14-16-18-20-24-28
1-9/16	18-20-24
1-5/8	5½-8-10-12-13-16-18-20-24
1-11/16	10-12-14-16-18-20-24
1-3/4	8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20-24
1-15/16	8-10-12-14-16-18-20-24-28
2	4½-8-10-12-16-18-20
2-1/16	12-14
2-1/8	12-16-20
2-3/16	12-16
2-1/4	4½-8-12-14-16-18
2-5/16	12-18
2-3/8	12-16-18
2-1/2	8-10-12
2-9/16	18
2-5/8	12-16-20
2-3/4	16
2-7/8	8-12-16
3	8-16
3-1/4	8-12-16
3-1/2	8-12-16
3-7/8	6
4	8-12



HIGH SPEED LEFT HAND TAPS

SIZE	THREAD
0	80
1	56-64-72
2	56-64
3	56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-30-32-40
12	24-28-32
1/4	20-28-32
5/16	18-20-24-28-32
3/8	16-24-32
7/16	14-20-28
1/2	12-13-20-28
9/16	12-18-20-24
5/8	11-12-18-20-24
11/16	11-16-24
3/4	10-16-18-20
13/16	16
7/8	9-12-14-18-20
1	8-12-14-16-18-20
1-1/8	7-12
1-1/4	7-12-16-18
1-3/8	6-8-10-12-16-18-20-24
1-7/16	8-10-12-14-16-18-20
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	8-10-12-14-16-18-20
1-11/16	8-10-12-14-16-18-20
1-3/4	8-10-12-14-16-18-20
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20
1-15/16	8-10-12-14-16-18-20
2	4½-10-12

• *SPECIAL AND LEFT HAND DIES IN STOCK* •

NOTE: Oversize, Undersize, Metric, 64th and 32nd Size Taps Available for Quick Delivery. We stock Special Sizes in High Speed Milling Cutters, Slitting Saws, End Mills and Reamers.

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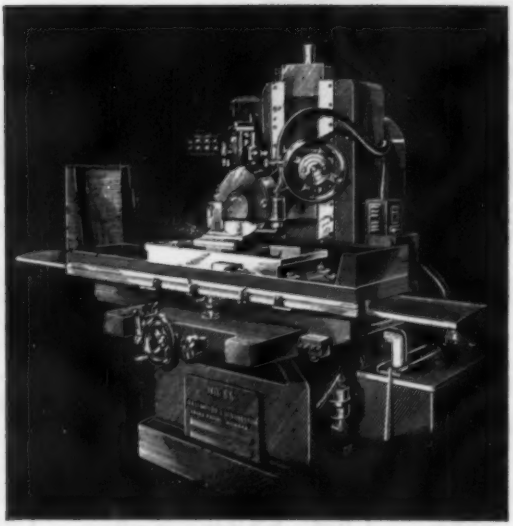

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- Is wheel head powered for rapid vertical travel?
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- Is longitudinal table capable of speeds to 125 fpm?
- Is it equipped with greased-for-life, pre-loaded ball bearing spindle?
- Does wheel head have 18 inch vertical movement?
- Is the spindle capable of speeds of 1925 and 2500 rpm?
- Does it have a 12" x 36" table working surface?
- Is it equipped with Bijur one-shot lubricating system?

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